



**UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration**

NATIONAL MARINE FISHERIES SERVICE  
Northwest Region  
7600 Sand Point Way N.E., Bldg. 1  
Seattle, WA 98115

March 11, 2002

Magalie R. Salas, Secretary  
Federal Energy Regulatory Commission  
888 First Street NE  
Washington, D.C. 20426

RE: Endangered Species Act Section 7 Consultation: Final Biological Opinion on Operation of the Rocky Reach Hydroelectric Project (FERC Project No. 2145) Including the Construction of a Juvenile Fish Bypass System. NMFS Consultation F/NWR/1999/01865.

Dear Secretary Salas:

Enclosed is the final biological opinion prepared by the National Marine Fisheries Service (NMFS) on the Federal Energy Regulatory Commission's (FERC) proposed license amendment regarding operation of the Public Utility District No. 1 of Chelan County (Chelan) Rocky Reach Hydroelectric Project, including the construction of a juvenile fish bypass system. This document represents NMFS' biological opinion on the effects of the proposed action on listed species and designated critical habitat in accordance with Section 7 of the Endangered Species Act of 1973 as amended (16 USC 1531 *et seq.*). This biological opinion is also being provided to Chelan as FERC's designated non-Federal representative.

In this biological opinion, NMFS has determined that the proposed action is not likely to jeopardize the continued existence of Upper Columbia River spring chinook salmon and Upper Columbia River steelhead. A complete administrative record of this consultation is on file with NMFS' Hydro Program in Portland, Oregon. The duration of this biological opinion is through July 12, 2006, when the FERC-issued license for this project expires.

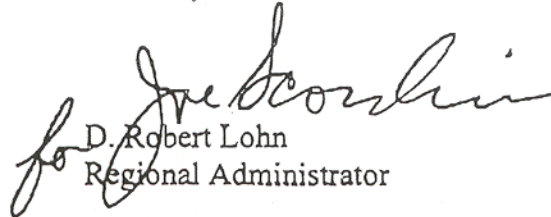
In addition to the biological opinion, enclosed as Section 13 is a consultation regarding essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). NMFS finds that the proposed action will adversely affect EFH for chinook salmon and coho salmon and recommends that the Terms and Conditions of Section 9 of the biological opinion, as well as the Conservation Recommendations of Section 10 of the biological opinion, be adopted as EFH conservation measures. Pursuant to MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal



agencies are required to provide a written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations.

Comments or questions regarding this biological opinion and MSA consultation can be directed to Ritchie Graves of the NMFS Hydro Program (503-231-6891).

Sincerely,



D. Robert Lohn  
Regional Administrator

cc: MCCC  
Rob Salter, Chelan PUD  
FERC Service List

**Endangered Species Act - Section 7 Consultation**

**BIOLOGICAL OPINION**

**and**

**MAGNUSON-STEVENSON FISHERY CONSERVATION  
AND MANAGEMENT ACT CONSULTATION**

**Operation of the Rocky Reach Hydroelectric Project  
(FERC Project # 2145) Including the Construction and  
Operation of a Juvenile Fish Bypass System**

**ESA/EFH Tracking Number F/NWR/1999/01865**

**Action Agency: Federal Energy Regulatory Commission**

**Consultation National Marine Fisheries Service,  
Conducted by: Northwest Region, Hydro Program**

**Date Issued: MAR 11 2002**

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### **APPENDIX A**

Summary of NMFS' Life-cycle Analysis for  
Upper Columbia River Spring Chinook Salmon and Steelhead

### **APPENDIX B**

Summary of Route Specific Passage Studies  
at Rocky Reach Dam, 1998 - 2001

### **APPENDIX C**

Briefing Paper: Estimating Survival of Anadromous Fish  
Through the Mid-Columbia PUD Hydropower Projects

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### **ABBREVIATIONS AND ACRONYMS**

BA	Biological Assessment
BC	Bypass Channel
BiOp	Biological Opinion
Chelan PUD	Public Utility District No. 1 of Chelan County
CRITFC	Columbia River Inter-Tribal Fish Commission
DFOP	Detailed Fish Operations Plan
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
GBT	Gas Bubble Trauma
IS	generating unit Intake Screens
JBS	Juvenile Bypass System
JDPS	Juvenile Dam Passage Survival (forebay, dam, and tailrace)
JPS	Juvenile Project Survival (reservoir, forebay, dam, and tailrace)
HCP	Habitat Conservation Plan
IPP	Interim Protection Plan
kaf	1,000 acre-feet
kcfs	1,000 cubic feet per second
kelt	adult steelhead that has spawned and is migrating downstream to the ocean
MCCC	Mid-Columbia Coordinating Committee
msl	mean sea level (elevation in feet above)
NMFS	National Marine Fisheries Service
PIT-tag	Passive Integrated Transponder tag
Project	Rocky Reach Hydroelectric Project (FERC No. 2145)
PUD	Public Utility District
SC	Surface Collector system
TDG	Total Dissolved Gas
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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### 1. OBJECTIVES

This is an interagency consultation between the Federal Energy Regulatory Commission (FERC) and the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the endangered Species Act (ESA) and implementing regulations found at 50 CFR Part 402. Under the Federal Power Act, FERC has discretionary authority regarding the license conditions under which privately owned hydroelectric projects are operated. NMFS is responsible for administration of the ESA for anadromous salmonids. Public Utility District No. 1 of Chelan County, hereafter referred to as “Chelan PUD”, owns and operates the Rocky Reach Hydroelectric Project (FERC No. 2145) located on the mainstem Columbia River.

Chelan PUD has filed an application for FERC approval of an amendment to its license authorizing construction, operation, and maintenance of a permanent fish bypass system. FERC and Chelan PUD, FERC’s officially designated non-Federal representative for the informal phase of this ESA consultation, propose to 1) construct and operate a juvenile fish bypass system, 2) take additional actions to improve the survival of anadromous fish within the boundary of the project, and 3) continue evaluating salmonid survival through the project and implement additional measures in the event that survival standards are not met at the Rocky Reach Hydroelectric Project as currently specified in the draft Habitat Conservation Plan.<sup>1</sup>

In the Biological Assessment (BA), FERC concluded that the construction of the permanent juvenile fish bypass system at the Rocky Reach Hydroelectric Project (RRE) would not likely adversely affect Upper Columbia River (UCR) spring chinook salmon (*Oncorhynchus tshawytscha*) or UCR steelhead (*Oncorhynchus mykiss*) or result in the adverse modification of their critical habitat. NMFS cannot concur with FERC’s conclusion with respect to UCR steelhead. Adult UCR steelhead will be migrating in the vicinity of the RRE project during the construction period. As noted in the BA, construction related effects are likely to include noise from demolition or pile drilling, oil or solvent spills, and disturbance of sediments; all of which could negatively affect adult UCR steelhead migrating in tailrace, fishways, or forebay of the RRE project. Therefore, NMFS considers effects resulting from the construction of the juvenile bypass system on adult UCR steelhead in addition to project effects and mitigation measures on UCR spring chinook salmon and steelhead in this consultation.

This Biological opinion analyzes the effect of these actions at RRE project on two species of salmon listed as endangered: UCR spring chinook salmon and UCR steelhead. Critical habitat for these species was designated on March 17, 2000 (50 CFR Part 226). The designation of critical habitat provides notice to Federal agencies that these areas and features are vital to the conservation of these species.

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<sup>1</sup> Draft Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach Project, July 30, 1998. NMFS and Chelan PUD expects to sign a modified version of the 1998 HCP before April 15, 2002.

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The objective of this Biological opinion is to determine whether the construction and operation of a juvenile fish bypass system and continued operation of Chelan PUD's Rocky Reach Hydroelectric Project, as described in Section 3 of this document, is likely to jeopardize the continued existence of UCR spring chinook salmon or UCR steelhead; or result in the adverse modification of their critical habitat.<sup>2</sup>

The duration of the action considered in this Biological opinion is through July 12, 2006, when FERC-issued license for this project expires. NMFS fully expects that either 1) a Habitat Conservation Plan (HCP) developed by Chelan PUD will supersede this action in 2002, following resolution of remaining issues, environmental review, and ESA Section 10(a)(1)(b) compliance, or 2) FERC will issue a new license for the project in 2006. In either case, the new action would require subsequent consultation with NMFS under Section 7(a)(2) of the ESA. This consultation does not consider the effect of actions pertaining to hatchery compensation. These actions will be addressed in separate biological opinions and corresponding Section 10 permits.

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<sup>2</sup>FERC in its capacity as a regulatory agency and through its licensing authorities under the Federal Power Act will consider for approval the actions proposed by the licensee.

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### **2. BACKGROUND**

#### **2.1. Events Leading Up to the Current Consultation**

In August 1997, NMFS listed UCR steelhead as endangered under the ESA. On October 9, 1997, the Chelan PUD petitioned FERC for approval of an Interim Protection Plan (IPP) for UCR steelhead at the RRE project. The IPP described interim fish protection measures intended to avoid, reduce, and mitigate for the effects of project operations on UCR steelhead. It was developed to govern project operations until parties to the mid-Columbia proceeding could reach a settlement agreement resolving Federal Power Act and Endangered Species Act issues relating to certain anadromous species. The agreement would also provide for the implementation of a Habitat Conservation Plan (HCP) in support of an incidental take permit issued pursuant to section 10 of the Endangered Species Act. In November 1997, FERC designated the PUD its non-Federal representative for the purpose of developing a draft biological assessment on the effects of the proposed IPP for UCR steelhead. The PUD submitted a draft biological assessment to FERC in February 1998.

In a March 26, 1998, letter to NMFS, FERC requested consultation regarding the effects of the IPP on UCR steelhead and conferencing regarding UCR spring chinook salmon (listed as endangered in March 1998). A final biological assessment of the Rocky Reach Hydroelectric Project IPP was attached. Implementation of the proposed action was to continue from 1998 until the HCP was implemented or until December 31, 2000, at which time the provisions of the IPP would remain in effect subject to review and amendment through reinitiation of consultation. FERC concluded that the actions described in the IPP were not likely to adversely affect UCR steelhead and not likely to jeopardize UCR spring chinook salmon.

In a July 14, 1998, letter to FERC, NMFS did not concur with FERC's conclusion that the IPP was not likely to adversely affect UCR steelhead. In addition, because the biological assessments attached to the March 26, 1998, request for consultation did not address UCR spring chinook salmon, NMFS could not evaluate the basis of FERC's not-likely-to-jeopardize conclusion for that species. NMFS stated that formal consultation would be required to evaluate the effects of the IPP on both UCR spring chinook salmon and steelhead. NMFS also requested that the proposed action be modified to include Chelan PUD's participation in, and funding of a quantitative analytical report (QAR), intended to analyze and develop biological requirements for survival and recovery of ESA listed species, and a multi-year steelhead adult passage survival study. Additional discussions between NMFS, the Chelan PUD, and FERC resulted in modifications to the proposed action and the analysis of this action in a biological assessment.

On February 1, 1999, the PUD provided NMFS with a draft biological assessment evaluating the effects of the Rocky Reach Hydroelectric Project IPP on UCR spring chinook salmon. Juvenile and adult fish passage plans, a predator removal plan, and monitoring and research plans were provided on April 1, 1999. This additional information applied to both UCR spring chinook

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salmon and UCR steelhead. NMFS considered formal consultation with FERC on the RRE project to have been initiated on April 2, 1999, following receipt by NMFS of all the information (at least in draft form) necessary to conduct this consultation, as described in 50 CFR 402.14(c).

Based on the information provided for the RRE project, additional information provided by the Chelan PUD for the Rock Island Hydroelectric Project, and information provided by the Douglas and Grant county PUDs for the Wells and Priest Rapids hydroelectric projects, respectively, NMFS produced a pre-decisional review draft biological opinion on August 26, 1999. The review draft biological opinion consolidated the information and proposed actions from all four FERC-licensed hydroelectric projects [Wells, Rocky Reach, Rock Island, and Priest Rapids (the Priest Rapids Hydroelectric Project includes both the Priest Rapids and Wanapum dams)] and evaluated the effects of these operations over the entire Mid-Columbia River reach. NMFS elected to coordinate consultations on each of the separate FERC actions in an attempt to streamline the consultation process while facilitating a quantitative assessment of the cumulative effects associated with all five dams.

Consultation meetings were then held with all of the PUDs (Douglas County, Chelan County, and Grant County) and FERC non-decisional staff on September 9, 1999, and on October 5, 1999, and with FERC and the Douglas and Chelan PUDs on September 17, 1999. Additional technical consultations were held with the Grant County PUD on October 15, 1999. Chelan PUD provided written comments specific to the initial draft biological opinion on September 8, 1999 and on September 30, 1999.

Many of the initial concerns expressed by the PUDs were addressed during these consultation meetings and during informal discussions over the following two months. Several issues pertaining to the HCP agreements proposed by the Douglas and Chelan PUDs, however, continued to complicate the coordinated consultation process. Therefore, on January 20, 2000, NMFS elected to separate FERC actions back into independent consultations. On February 9, 2000, Chelan PUD provided additional technical comments on the August 26, 1999, review draft biological opinion. [The Douglas County PUD consultation regarding continued operations of the Wells Hydroelectric Project was concluded on June 19, 2000.]

Chelan PUD's initial comments highlighted discrepancies between NMFS' mandated requirements under ESA Section 7, as presented in the August 26, 1999, review draft biological opinion, and agreements made under the draft HCP for the RRE project (written comments provided on September 8, 1999). Specifically, the review draft biological opinion required the immediate implementation of additional protection measures at the project. In contrast, the proposed 1998 HCP agreement allowed Chelan PUD the ultimate decision on pursuit and implementation of mitigation measures during Phase I (through March 1, 2003). A significant amount of discussion occurred during the consultation process to resolve this inconsistency. On March 17, 2000, NMFS and the Chelan PUD reached an agreement on the proposed action that resulted in initiating immediate measures for ESA listed species while preserving the

## **2002 Rocky Reach Hydroelectric Project Biological Opinion - March 11, 2002**

fundamental agreements reached, and the time periods developed during the HCP negotiations. These agreements were documented in an April 4, 2000, letter from Brian J. Brown (NMFS) to Steve Hays (Chelan PUD).

A second draft Biological opinion specific to the Rocky Reach Hydroelectric Project was provided to FERC and Chelan County for review on August 18, 2000. Concurrent with the development of the Rocky Reach second draft Biological opinion, NMFS developed a draft environmental review document for the proposed HCP. After months of coordination and revision, the draft Environmental Impact Statement for the HCP was released for public review on December 29, 2000, and comments were received through May 1, 2001. Chelan PUD filed a notice of withdrawal of its IPP in July, 2001, which became effective in accordance with FERC regulation.

### **2.2. Consultation History**

For several years Chelan PUD has been evaluating the ability of a surface bypass system to meet the juvenile survival goals agreed upon in the proposed HCP. This work has culminated in a design which Chelan PUD and several agencies believe is likely to meet these standards either by itself, or with some level of voluntary spill. By letter dated March 13, 2001, FERC designated Chelan PUD its non-Federal representative for the purpose of preparing a draft biological assessment to determine the potential effects of the proposed bypass system on listed species. Numerous meetings were held with NMFS and other Federal, state, and tribal agency representatives to identify, discuss, and resolve technical issues relating to the construction and operation of the bypass facility<sup>3</sup> and the development of the draft biological assessment.

On February 26, 2001, Chelan PUD filed an application for a license amendment authorizing the construction and operation of a permanent fish bypass system. On March 9, 2001, FERC issued a notice of the proposed license amendment to construct the juvenile bypass system. NMFS intervened in the license amendment proceeding on April 6, 2001. By letter dated May 22, 2001, NMFS addressed a number of license amendment applications, recounted events leading to amendment of the IPP and the environmental review process of the HCP, and noted the need for ESA consultation regarding the amendment applications, especially for the bypass facility, and requesting clarification from FERC regarding the status and scope of consultation..

On December 4, 2001, NMFS expressed its understanding, based on its latest discussions with Chelan PUD, of the scope of the consultation (letter from B. Brown [NMFS] to R. Salter [Chelan PUD]). Chelan PUD filed a final draft biological assessment with FERC on December 5, 2001

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<sup>3</sup> These discussions and their results are summarized in the February 8, 2002 letter from C. Hosken (Chelan PUD) to M. Salas (FERC) and the February 20, 2002 letter from B. Brown (NMFS) to D. Sampson, T. Weaver, and C. Merkle (representatives of the Yakama and Umatilla tribes) cited below in Section 2.

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(letter from J. Vasile [representing Chelan PUD] to D. Boergers [FERC]). On December 13, 2001, FERC formally requested consultation with NMFS; attaching a final BA which concluded that the construction of the juvenile bypass system would not likely adversely affect UCR spring chinook salmon or UCR steelhead, but that the operation of the juvenile bypass system was likely to adversely affect these species (letter from A. Miles [FERC] to B. Lohn [NMFS] and G. Jackson [USFWS]). On January 8, 2002, NMFS notified FERC and Chelan PUD of its finding that the BA was sufficient for the purpose of completing a biological opinion (BiOp) on the proposed action.

On January 14, 2002, the Columbia River Inter-Tribal Fish Commission (CRITFC) on behalf of the Confederated Tribes and Bands of the Yakama Nation (Yakama Tribe), the Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribe), the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Nez Perce Tribe notified NMFS, USFWS, and FERC of their opposition to the construction and operation of the juvenile bypass system (letter from D. Sampson [CRITFC] to B. Lohn [NMFS], A. Badgley [USFWS], and L. Watson Jr. [FERC]). This letter also provided the basis for their opposition via preliminary comments relating to ESA / NEPA process issues and the technical merits of the juvenile bypass facility.

In addition to the consideration and discussion of the Tribes' concerns with the bypass facility at the mid-Columbia coordinating committee meetings, RRE project relicensing meetings, HCP negotiation meetings, and bypass technical workgroup meetings, NMFS staff met with staff of the individual tribes and of the Columbia River Inter-Tribal Fish Commission on numerous additional occasions between March, 2001 and March, 2002 where technical issues relating to the bypass facility were discussed.<sup>4</sup> In addition, the bypass facility was discussed at a meeting between NMFS' Regional Administrator and staff and the members of the Yakama Nation Tribal Council and staff on January 31, 2002.

On February 8, 2002, Chelan PUD filed a response to CRITFC's letter to FERC. The Chelan PUD letter addressed many of the major points CRITFC raised (letter from C. Hosken [Chelan PUD] to M. Salas [FERC]). Also included in this response were minutes of workshops and several meetings held to discuss the juvenile bypass system. NMFS also responded to CRITFC's letter in a February 20, 2002, letter from B. Brown (NMFS) to Sampson (CRITFC), T. Weaver (representing the Yakima Tribe), and C. Merkle (Umatilla Tribe) indicating NMFS' reasons for determining that a bypass facility would likely provide greater biological benefits to juvenile migrants than a sluiceway option at the RRE project.

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<sup>4</sup> B. Nordlund, NMFS fish passage engineer, met with CRITFC and/or Yakama Indian Nation staff on March 29, November 7, 2001 and February 28, 2002 and R. Graves, NMFS fish biologist, met with CRITFC and/or staff on January 22, 2002 and February 11, 2002.

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### **3. PROPOSED ACTION**

This section summarizes the proposed action as described in FERC's BA of December 13, 2001. The action involves Chelan PUD's proposal to 1) permit, construct and operate a juvenile bypass system at the Rocky Reach Hydroelectric Project, 2) implement measures (including voluntary spill and predator hazing/removal) to improve the survival of anadromous fish within the boundary of the project, and 3) evaluate salmonid survival through the project and implement additional measures in the event that survival standards are not met at the RRE project as currently agreed upon in the Habitat Conservation Plan negotiations (letter from B. Brown [NMFS] to R. Salter [Chelan PUD] dated December 4, 2001).<sup>5</sup> Chelan PUD proposes to meet the HCP standards by 2004: 95% Juvenile Dam Passage Survival or 93% Juvenile Project Survival or 91% Combined Adult and Juvenile Project Survival. The proposed action is intended to be consistent with both the FERC relicensing process and with the proposed HCP for salmon and steelhead. The proposed action is analyzed in Section 6.

#### **3.1. Rocky Reach Project Description**

Rocky Reach Hydroelectric Project (FERC Project No. 2145) was completed in 1961 and is located within the State of Washington on the mainstem Columbia River at river mile 473.7. The Rocky Reach Hydroelectric Project (RRE) impounds 43 river miles and has a surface area of 98,000 acres at the normal pool elevation of 707 feet msl. Its hydraulic head is 88 feet with a normal tailrace elevation of 619 feet msl. Based on a draft limit of four feet, usable storage is 35,000 acre-feet. The project includes a spillway, powerhouse, and an earthen embankment section (see figures in the Biological Assessment). The spillway consists of 12 spillway gates with a combined capacity of 1,200 kcfs. The powerhouse 11 Kaplan turbine units, four of which are larger with a combined hydraulic capacity of 197 kcfs producing 1,213 MW of electricity. (Chelan PUD 2002).

#### **3.2. Project Operations**

##### **3.2.1. Powerhouse Operations**

Turbines will be operated as efficiently as possible (within 1% of the peak efficiency for a given head and megawatt output) during the juvenile fish passage season (Truscott 2002). During the juvenile migration season, when the proposed juvenile bypass system is operating, the powerhouse units will be loaded favoring Units 1 and 2. This will be done to enhance fish attraction flows near the entrance of the surface collector. The Upstream Migrant Fish Passage system (ladders) will also be in operation during the juvenile fish passage season.

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<sup>5</sup>A more detailed discussion of each element of the proposed action can be found in the BA.

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### **3.2.2. Spillway Operations**

Chelan PUD proposes to operate the RRE spillway when river flows exceed powerhouse hydraulic capacity or, if necessary, to meet fish survival requirements. Spill will supplement the JBS for the 2002 through 2006 juvenile migrations, and until such time that the MCCC determines that the survival standards for each species can be achieved with either reduced or with no spill. In 2002 and 2003, Chelan PUD proposes to spill 15% of the daily average flow for a period covering 95% of the juvenile migration<sup>6</sup>. This spill will either be provided continuously on a daily basis or, with the approval of the MCCC, may be shaped within each 24 hour period to enhance the effectiveness of this spill volume (C. Peven [Chelan PUD], pers. comm., March 5, 2002). The determination of when to start spill will be made by the MCCC. In addition spill levels will likely be re-adjusted in 2004 to 2006 based on results of the 2003 pilot studies (see Section 3.5).

In addition, Chelan PUD proposes to limit voluntary spill to provide alternative fish passage at RRE project to the extent necessary to comply with the Clean Water Act and State of Washington's total dissolved gas (TDG) standards. Spilling water at hydroelectric projects entrains atmospheric gasses. High concentrations of such gasses can harm aquatic organisms including salmon and steelhead. However, spilling water provides outmigrating juvenile salmon and steelhead with a non-turbine route of dam passage, thereby improving project survival. Project operators and resource agencies work to manage spills to maximize fish benefits by spilling water in a manner that avoids excessive TDG. In recent times, during the juvenile migration season, the State of Washington has issued a waiver to existing TDG standards to enhance juvenile migration conditions in the mainstem migration corridor. Washington State water quality standards for the Columbia River allow TDG levels of 120% when spill is provided for fish passage. Proposed water quality standards, currently in rule making, continue this provision, thus TDG levels of up to 120% will continue to be allowed at least through 2006.

Up to the 100-year flood design level for the BC, the spillway operations will not impact the bypass system operations. The bypass system will be shut down if the forebay elevation exceeds 708 feet. The SC and IS bypass pipes upstream of the ring follower gates should be flooded by way of the flushing gates any time the forebay exceeds 708 feet (see Section 6.3.2 of the BA for additional information).

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<sup>6</sup> Additional spill (25% of the daily average flow) will be provided in 2002 and 2003 to improve passage conditions for juvenile sockeye salmon provided that the HCP is signed. After 2003, this spill level will most likely be readjusted based on route specific passage information collected in 2003 such that the overall fish passage efficiency of the dam passage routes for sockeye salmon is approximately 47 percent (HCP negotiations - February 2002).

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### **3.2.3. Adult Fishway Operations and Measures**

Chelan PUD proposes to emphasize adult project passage measures in order to give high priority to adult survival in the achievement of 91% Combined Adult and Juvenile Project Survival for adult UCR spring chinook salmon and steelhead as described in the draft HCP and in more recent negotiations. To accomplish this, Chelan PUD proposes to implement at least the following measures:

- Use best efforts to maintain and operate adult passage systems at the RRE project according to criteria developed through the MCCC and as provided in the Detailed Fish Operating Plan.
- Address areas within the adult fish passage systems continuously out of criteria or where significant delay occurs (as it relates the biological fitness of the adults).
- Use best efforts to eliminate identified sources of adult injury and mortality during adult migration through the dam.
- Identify adult fallback rates at the dam. This evaluation will include the magnitude of voluntary and involuntary fallback, will assess how ladder trapping, project operations, the influence of the Turtle Rock Fish Hatchery, and the Wenatchee River have upon observed rates of fallback. This assessment will also determine the biological significance of such fallback events on the overall fitness of adult UCR spring chinook salmon and steelhead. The MCCC shall determine the most cost effective methods to protect adult fallbacks and steelhead kelts at the dam, and Chelan PUD shall implement these measures. Reduction in fallback rates, mortalities and protection of kelts shall be factored into juvenile bypass and adult passage development and implementation and into project operation decisions. Before Chelan PUD implements additional operation of the bypass system or other measures for kelts or fallbacks, there will need to be a high level of certainty that these measures will make a significant difference in meeting the relevant HCP survival standard.

### **3.3. Construction of the Juvenile Bypass System**

Chelan PUD proposes to construct and operate a juvenile bypass system (JBS) in the cul-de-sac portion of the forebay bounded by the powerhouse to the east, the forebay wall to the south, and the shoreline to the west. The JBS would be constructed in three phases and consists of four major components: a surface collection system (SC), generating unit intake screens (IS), a bypass channel (BC), and a juvenile sampling facility. Phase I includes the construction and

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installation of one SC entrance, dewatering screens, a pump system, IS in generating units 1 and 2, and a BC. Phase I is scheduled to be operational by April 2003. Depending upon the performance of Phase I measures, Phase II, if implemented, would include the addition of a second entrance for the SC (two 3,000 cfs entrances instead of a single 6,000 cfs entrance). Similarly, if Phase II measures do not perform as expected, Phase III may involve the installation of a third unit of IS. No modifications to the BC are planned during Phases II and III. Phases II and III will be implemented only as necessary to address provisions in the draft Habitat Conservation Plan (HCP) (see below for more information), or as required by other Endangered Species Act (ESA) required mandates, depending on the process eventually implemented to govern anadromous fish mitigation efforts.

Chelan PUD has prepared final plans and specifications for the Rocky Reach Fish Bypass project. The goal is to obtain necessary approvals to begin installation of the JBS following the 2002 juvenile migration period (August or September 2002) and make the JBS operational by April 2003 - prior to the juvenile migration period. The project is a major step in Chelan PUD's long term effort to improve survival of juvenile anadromous fish at Rocky Reach Dam. This construction project description identifies major project components and describes the expected construction techniques. Additional details can be found in the BA prepared by Chelan PUD.

### **3.3.1. Construction of the Surface Collector**

#### ***3.3.1.1. Design***

The proposed collector is a steel structure supported on piles in the forebay area that ranges in depth from 30 feet to 110 feet. The collector is comprised of the following five major components:

- 6,000 cfs collector entrance that is 40 feet wide and 57 feet deep
- a trashrack and dewatering screens
- 5,760 cfs pump station with adult fish diffuser outlet
- the SC piping which conveys 240 cfs and
- intake screen bypass located in the forebay

When completed, the collector system will draw in 6,000 cfs (6,000 cfs from the single entrance of Phase I or 3,000 cfs from each of two entrances with Phase II) from a location in the forebay that prototype testing has shown to contain downstream migrating fish. That flow will then be dewatered to 240 cfs containing the fish and minor amounts of floating debris and be delivered to the BC. Large debris will be removed from the flow at the trashrack. The pump station will provide the head required to lift the 5,760 cfs of dewatered flow back into the forebay by way of

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the diffuser. The intake screen bypass, part of the fish bypass system, will initially deliver 120 cfs (potentially adding another 60 cfs later) from the existing intake screen system to the BC.

### **3.3.1.2. Construction**

In order to complete construction by March 2003, specialty items such as dewatering pumps, electrical equipment, and wedge wire screen that may require long lead times have been ordered. Site construction will commence as governing permits are received. Chelan PUD anticipates that a single contract will be let for all work related to the construction of the SC, which will be advertised for bids from January 15 to March 15, 2002. This contract will involve the following major components:

- Demolition and removal of all prototype equipment (except for six existing pilings that will be used in the permanent system) including the BC and juvenile sampling facility
- Shop fabrications of fabricate metal components and shipment to the site
- Manufacture of required equipment at off-site facilities and shipment to the site
- Underwater construction to install support piles (54 new) and attachments to the existing concrete powerhouse and forebay wall
- Field assembly of fabricated steel components and erection in the forebay.
- Receipt, acceptance and installation of pumps and electrical and controls equipment

A detailed account of these activities can be found in the BA. Items that will be placed in the water during pile installation include steel pipe, steel rods, steel cable, aluminum rods, and diamond drill bits. Drilling fluid (Shorepak polymer) and cementitious grout will be placed through the water on the inside of the drill casing. Materials that could enter the water if spilled include Delo Motor oil, Mobil EAL 224H vegetable oil, and diesel fuel.

### **3.3.2. Construction of the Bypass Channel**

#### **3.3.2.1. Design**

The BC is designed to convey 240 cfs from the SC and 180 cfs from the IS (120 cfs initially) to the tailrace of Rocky Reach Dam. The outlet site was selected after extensive physical modeling and field tests to determine the optimum location to release the downstream migrating fish collected in the SC and the IS. The focus of these efforts was to determine an outlet location that minimizes predation on juvenile salmonids.

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The BC is comprised of approximately 4,600 feet of 5ft to 9ft diameter welded steel pipe, welded steel flume, concrete flume, and corrugated metal pipe. The major components of the BC are as follows:

- Ring follower gates, forebay wall penetrations, and bypass control structures, for both the SC and intake screen flow lines
- Elevated large diameter welded steel pipe and steel flume with pipe supports around the forebay wall, service bay, and tailrace deck of the powerhouse
- Elevated large diameter welded steel pipe with pipe supports across the center dam and spillway piers
- At grade or partially buried concrete flume, corrugated metal pipe, and metal pipe on the Eastbank area, including sampling screen and juvenile fish sampling facilities adjacent to existing Annex Fish Hatchery
- Utility and road relocations to accommodate construction
- Pier supported elevated pipe out into the Columbia River at the selected outfall location

When completed the BC system will allow for the bypass of up to 420 cfs of flow containing downstream migrating fish from the SC to the tailrace of Rocky Reach Dam.

### **3.3.2.2. Construction**

The construction of the major components of the BC will be covered in one construction contract. The pipe and pipe supports will be fabricated off-site in the manufacturer's shop facilities and shipped to the general contractor on-site. The major components of this construction contract will be:

- Pipe and pipe support fabrication and shipment
- Control gate manufacture and shipment to site
- Site preparation including grading and foundations
- Field assembly and erection of the pipe, control structures, and supports
- Erection of the BC across the river on the spill way piers
- Construction of two outfall piers (Piers 0 and 1) on the bank of the river

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- Construction of three outfall piers (Piers 2, 3, and 4) in the river
- Erection of the outfall pipe over the river
- Testing and start up of the bypass facilities

A detailed account of these activities can be found in the BA. Chelan PUD expects that the contractor will select one of three options (barge, trestle, or sheet pile) to gain access to install Piers 2 through 4. The trestle method will most likely be the construction method used.

The fill used during construction will be approved by the Washington Department of Fish and Wildlife. Chelan PUD has completed consultation with the agency on specifications of fill to minimize water quality effects during construction.

### **3.3.3. Construction Schedule**

The in-water construction schedule has been proposed after discussion with WDFW and NMFS for both forebay and tailrace construction activities. Major portions of the work in the forebay will be performed from approximately September 3 to March 31. Work in the tailrace will be performed from approximately September 3 to March 31. Chelan PUD is in the process of obtaining permits so field work above water can start in April 2002 for the BC. Demolition of the prototype fish bypass equipment would occur after the 2002 juvenile migration or no later than September 3, 2002.

SC drilling crews will begin work about September 3, 2002,<sup>7</sup> or earlier if 95% of the juvenile run has passed Rocky Reach prior to that time as determined by the Mid-Columbia Coordinating Committee. Field work on the IS system will start about October 1, 2002. Work on the SC, BC, and IS systems is scheduled to be completed by April 1, 2003. NMFS will conduct both an inspection of the assembly of the screen panels prior to installation (they can't be viewed underwater) and a post construction inspection prior to system start-up.

### **3.3.4. Evaluation and Mitigation Measures**

Because construction will occur at a time when juvenile UCR spring chinook salmon and steelhead and adult UCR Spring chinook salmon are expected to be absent from the Action Area, no impacts are expected. However, it is likely that some adult UCR steelhead will be present during construction activities.

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<sup>7</sup> Following receipt of all necessary permits, Chelan PUD began drilling piles on February 7, 2002 and will continue until the juvenile outmigration begins (April) to minimize the potential effect of pile drilling on adult UCR steelhead migrating in the fall of 2002 and maximize the likelihood that the bypass will be fully operational prior to the 2003 juvenile outmigration.

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Chelan PUD proposes to implement a radio telemetry study (see BA for a more detailed description of the radio telemetry setup) to monitor and evaluate potential construction related impacts on the migrational characteristics of adult steelhead. Effects on adult steelhead migration will be determined by comparing pre-construction to during- construction migrational characteristics (e.g., delay in locating, ascending, and exiting the adult fishway). Adverse effects can be measured by examining time spent in the fishways, time required to migrate from the exit of the fishway to a predetermined upstream location (e.g., Turtle Rock Island), or dropback rates (English et. al. 1998 described this process in which fish partially ascend a fishway only to turn around and descend).

Pre- versus during-construction dropback rates at the counting window near the exit of adult fishway will also be evaluated to determine if construction activities are negatively affecting the UCR steelhead migrating through the Project (Truscott 2002).

### **3.3.5. Triggers That Could Affect a Change in Construction**

Chelan PUD proposes the following measures as triggers for determining if construction activities should be halted or modified. However, after additional discussion at the March 5, 2002 MCCC meeting it is apparent that these triggers need to be further development. Thus, the following triggers should be viewed as a starting point for future MCCC discussions to further develop and refine triggers for determining if construction activities should be halted or modified (C. Peven, pers. comm. March 7, 2002).

#### **3.3.5.1. *Fallback/Dropback***

Chelan PUD proposes to monitor dropback rates before and during construction by radio-tracking approximately 50 adult steelhead and monitoring fallback at the fishway counting window (Truscott 2002). If, during construction, evaluation and monitoring activities determine that adult fallback/dropback has increased by 25 percentage points when compared to pre-construction rates, then Chelan PUD will immediately consult with NMFS (and the MCCC to the extent possible) to determine the appropriate action, which may include stopping construction.

#### **3.3.5.2. *Delay***

Chelan PUD proposes to compare mean passage times of radio-tagged adult steelhead both before (including information from previous years) and during construction. If, during construction, evaluation and monitoring activities determine that mean passage times (from the ladder exit to approximately Turtle Rock) have increased by more than two days when compared to pre-construction rates, then Chelan PUD will immediately consult with NMFS (and the MCCC to the extent possible) to determine the appropriate action, which may include stopping construction.

#### **3.3.5.3. *Mitigation Measures***

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If the radio telemetry study suggests that construction of the SC or BC is impacting the migration of adult steelhead (increased rates of fallback/dropback or delay) Chelan PUD will coordinate with NMFS and the MCCC, then take the necessary mitigative actions to minimize these impacts as agreed to by NMFS. Possible mitigative measures may include postponing drilling of piles nearest the fishway exit until all other piles have been drilled, leaving those nearest the exit for last when the migration should be nearing its end.

### **3.3.6. Post-Construction Evaluation**

Prior to the juvenile migration in 2003, the JBS will be inspected by NMFS and the screens will be “hydraulically tuned” to ensure that “hot-spots” do not exist (areas in which through flows exceed the NMFS standard of 0.4 feet per second +/- 10%). An initial facility evaluation will be conducted prior to system startup using test fish from a nearby hatchery. The condition (including descaling and injury) of fish passing through the JBS (including the outfall) will be evaluated in coordination with the MCCC. In addition, Chelan PUD proposes to work with the MCCC to determine the feasibility of measuring survival or injury at the outfall, if needed.

The evaluations will begin immediately following construction and measures will be implemented, in coordination with NMFS and the MCCC, as necessary to correct obvious deficiencies. These deficiencies may be related to adverse effects on adult passage created by operation of the JBS or impacts to juvenile survival. The MCCC will oversee all aspects of standards, methodologies, and implementation.

### **3.4. Operation of the Juvenile Bypass System**

Chelan PUD will develop an operation and maintenance plan for the bypass system through coordination with NMFS before the system is completed. The draft operation and maintenance procedures will be submitted to NMFS for review by January 31, 2003, and a revised draft will be filed with FERC. Prior to operation, the JBS will be evaluated and deficiencies corrected (see Section 3.2.7. Post-Construction Evaluation).

Chelan PUD proposes to operate the JBS each year from April 1 to August 31, 24 hours each day, to provide a non-turbine route of passage for outmigrating juvenile UCR spring chinook salmon and steelhead. Fish condition (descaling and injury) for UCR spring chinook salmon and steelhead will be periodically evaluated in coordination with the MCCC.

#### **3.4.1. Entrance**

The combination of pump station, AWS intake, SC bypass, and the upper adult fish ladder supplemental flows will provide the flow into the SC entrance. The entrance flow will vary with forebay level by adjustment of the number of dewatering pumps in operation such that the entrance velocity remains constant. The relationship between forebay level and entrance flow

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(Phase I construction) is presented in Section 6.3.2 of the BA. If Phase II is implemented, the single 6,000 cfs entrance constructed in Phase I would be split into two 3,000 cfs entrances. The east half of the large single entrance would extend upstream along the powerhouse face to near Unit 4 potentially adding guide walls in the forebay upstream of the pump station. The entrance flow will be adjusted with change in forebay level to achieve a fixed entrance velocity.

### **3.4.2. Dewatering**

The dewatering structure includes the trashrack, dewatering screens, and the SC bypass system down to the ring follower gates. This system operates similarly to the existing prototype Entrance 1 primary and secondary screens.

New trashrack debris handling systems will improve handling and disposing of large debris. The main trashrack will have two trash rakes, which provide a backup rake and the ability to operate both rakes during high trash loading periods. The rakes will have an automatic operating cycle for unattended operation. However, experience with the prototype suggests that the rakes will need to be manually operated approximately 75 percent of the time, as the rakes must be accurately positioned under logs or other large trash to effectively lift them into the trash hoppers.

A new semi-automated trash handling system will be installed behind the racks. This system will have a trash pusher and hopper system that will elevate the trash high enough to dump it directly into Chelan PUD's long-bed dump trailers, parked at the 717-deck level. The system will require one operator to control lifting and dumping of the hopper system. A mobile crane will not be required for trash handling, except for debris which is too large to be picked up by the trash rakes—generally long logs, root wads or similar out-sized debris.

A new track mounted screen cleaner system will be operated to keep the dewatering screens clean. As it relates to operations, these two systems represent the greatest improvement over the systems previously developed for the prototypes. As with most systems of this type, the trash cleaning and screen cleaning systems will be computer automated to minimize staffing requirements. Debris cleaned from the screens will be flushed with the SC bypass water into the BC conduit. The debris size will be limited to sticks, milfoil and any other debris that can pass through the 6-inch bar spacing of the main trashracks.

The SC control gates will operate automatically to deliver 120 cfs per weir to the SC bypass at forebay levels above approximately 704. Below 704 the SC bypass flow will be reduced to 90 cfs per control gate. This reduced flow is needed at low forebay to enhance the hydraulics at the secondary screens and to provide better hydraulic conditions downstream of the SC control gate for more frequent higher forebay conditions.

Under shutdown conditions, the SC control gates will be raised to elevation 708. The SC flushing gate, located in the SC weir box, will open to provide approximately 48 cfs of flushing

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flow for SC bypass system start up and shut down.

### **3.4.3. Pump Station**

The pump station is designed with 29 constant speed submersible pumps. The computer automated pump station dispatches individual pumps as required to meet the flow requirements at the entrance. Basically entrance flow will be calculated as follows:

$$\text{Entrance Flow} = (\text{SC bypass flow} + \text{AWS intake flow} + \text{pump flow} + \text{Adult Fishway supplemental flow (added near the exit of the fishway)}) - \text{SC structure leakage.}$$

Velocities at the intake will be controlled based on this calculated flow and the flow cross-section at the intake. The flow cross section at the intake will be calculated based on the measured water level at the intake. Under design head conditions, each of the 29 pumps can provide 220 cfs of flow, so the entrance flow can be fine-tuned to the desired flow in increments of approximately 220 cfs. The pump flow rates will be calculated based on pump curves, adjusted for the gross head across the pumps.

### **3.4.4. Intake Screen**

The IS operations will be similar to those in the prototype. The Phase I bypass system will include IS systems in Units 1 and 2. A provision is made to add one more IS system on one additional powerhouse turbine-generator unit in the future if needed. The IS system will be made of six gatewell slide gates per generating unit (2 per intake bay) which will be computer automated to deliver 10 cfs at the most frequent forebay levels. At lower forebay levels, the flow will be reduced to a minimum of 6 cfs per gate at a 703 forebay level.

In addition to a constant flow from each gate well slide gate, the computer system will monitor and adjust, if needed, the tailwater level in each weir box to provide additional tailwater at higher forebay elevations if needed to optimize fish passage. This function will be provided by the IS Bypass control gate, as described below.

The prototype screen cleaner has been modified to provide for screen cleaning of the IS. Cleaning of the IS screens will occur on approximately a once per week schedule, based on prototype experience. All operating weir boxes should be inspected daily for trash accumulation and proper operation.

### **3.4.5. Bypass Conduit**

As it relates to operations, the bypass channel can be considered to consist of three distinct parts. The first is the BC itself, which for the most part is just a large conduit of either open flume or large diameter pipe flowing partially full in either sub-critical or super-critical flow from the Forebay Wall to the outfall. The second part is the SC and IS bypass control gates which are designed to fine tune the hydraulics in the SC and IS bypass systems to provide optimum fish

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passage. The third and most complex system is the sampling facility. The following is a description of these three systems.

### **3.4.6. Bypass Channel Flow Line**

Operations of the free flowing portions of the BC include periodic inspections at observation points, continuous computer monitoring for high level alarms and avian predator control through use of bird wires.

For a given flow delivered to the BC from the SC and IS there is a predictable water surface level at several key points along the BC. These points are at open flumes, observation ports or level transmitters. At key points in flumes, staff gages will be provided graduated in-project vertical datum so observers can verify proper water surface elevations for that particular station. Due to the difficulty of mounting staff gages in the observation points, the top of flange elevation will be given at each measuring point so “measure down” techniques can be used by observers. The level transmitter stations will report continuously to the central computer the water surface elevation at that point.

If at any point the water surface in the BC is 12 inches higher or lower than desired, the operators will take action to determine the cause and return the BC to proper conditions. Too high a water surface could mean that there is too much water flow coming into the BC or that there is a trash blockage somewhere downstream. Too low a water surface means there is not enough flow or there is a trash blockage upstream.

Major trash blockage events will require that the bypass system be shut down and trash removed. Minor amounts of trash may be removed by hand at key flume areas especially where sub critical flow occurs.

The avian predator control at the outfall will consist of bird wires or other measures, but can be retrofitted, if deemed necessary by the MCCC, with two water cannons similar to that used by the U.S. Army Corps of Engineers on the lower Columbia River Projects.

### **3.4.7. Surface Collector and Intake Screen Bypass Control Gates**

Although located in the BC just downstream of the forebay wall, these gates are operated by the main control system to maintain fish friendly conditions in the respective weir boxes. It is expected that the SC bypass control gate will be “checking up” the SC flow line more often than the IS bypass control gate will be needed to “check up” the IS weir boxes. Operational control of each of these gates is planned to be a closed loop control, which will maintain the water level upstream of each of these gates according to a relationship based on forebay level. This will provide the desired flow depth and submergence characteristics needed immediately downstream of the SC control gates and the IS weir box control gates.

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Since a short distance of open flume precedes the SC bypass control gate, this portion of the BC can be inspected periodically for trash buildup. The trash buildup can only be determined by experience but if the SC weir box is showing a lot of trash, it will move down to the SC bypass control gate. Most of the trash that makes it to the SC bypass control gate will pass under the gate. If there is too much buildup the gate should be raised and the trash passed downstream.

The IS bypass control gate does not have the open flume upstream like the SC bypass control gate. The IS bypass control gate should be opened fully twice a day to ensure trash is not building up behind it. This frequency should be adjusted based on operating experience. Again if large trash accumulations are noted in the IS weir boxes, the IS bypass control gate could have the same problem and should be opened. If large trash accumulations occur in the gatewells immediately upstream of the weir boxes, the VBS panel hoists can be operated to flush the accumulated trash through the generating units.

### **3.4.8. Sampling Facility**

Chelan PUD proposes to periodically operate the sampling facility, in a manner consistent with the existing ESA section 10 permit, to support Chelan PUD's monitoring and evaluation efforts. As detailed in the BA, during normal operations this will include:

- Using the sample screen control gate to provide 20 cfs of bypass flow into the sampling facility.
- Ensuring that all screens in the facility are cleaned as detailed in the BA when level sensors indicate water differentials > 0.25 feet are occurring.
- Using the sample screen control gate to prevent excessive screen pressure differential in the event of an emergency situation, forcing spill over the emergency spill weir.
- Ensuring that Chelan PUD operators promptly remove any trash accumulating in the entrance of the sampling facility, particularly at the adult/juvenile separator.

### **3.4.9. Triggers That Could Affect a Change in JBS Operations**

Through monitoring and evaluation efforts, Chelan PUD proposes to routinely assess the condition of fish traveling through the JBS to ensure that the facility is operating as expected - providing a safe route of passage for juvenile (and adult) salmon and steelhead. If negative changes to any one of the following are noted, then Chelan PUD proposes to consult with NMFS and take corrective actions if identified. In addition, Chelan PUD proposes to continually refine and modify these triggers, in coordination with the MCCC, in response to results from ongoing monitoring and evaluations.

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### ***3.4.9.1. Juvenile Triggers***

#### ***Descaling or Injury***

If, during evaluations and monitoring, Chelan PUD observes a sharp increase in descaling/injury above ambient levels (i.e., a 5 percentage point increase in descaling over ambient levels for any given species), then the trashracks and dewatering screens (and other potential locations of debris build up) will be immediately inspected and cleaned as necessary. If descaling/injury rates remain at these elevated levels for three consecutive days, systematic releases of test fish will be made near the downstream end of the system continuing upstream until the problem is located. If problem areas (i.e. debris blockages) are not found, then NMFS and the MCCC will be consulted to determine appropriate actions, which may include shutting down the system for a more intrusive investigation.

#### ***Mortality***

If a sharp increase in mortality occurs (i.e., a 5 percentage point increase [absolute] over ambient levels for any given species), then the trashracks and dewatering screens (and other potential locations of debris build up) will be immediately inspected and cleaned as necessary and system components will be inspected for proper operation. If mortality rates remain at these elevated levels for three consecutive days, systematic releases of test fish will be made near the downstream end of the system continuing upstream until the problem is located. If problem areas (i.e. debris blockages) are not found, then NMFS and the MCCC will be consulted to determine appropriate actions, which may include shutting down the system for a more intrusive investigation. If mortality exceeds 5% in any one day for any given species, then NMFS and the MCCC (to the extent possible) will be immediately consulted to determine appropriate actions, which may include shutting down the system for a more intrusive investigation.

#### ***Abnormal Injuries***

If, during monitoring and evaluation efforts, Chelan PUD personnel observe abnormal injuries (e.g., torn operculum, punctures, etc.) to fish, then Chelan PUD will investigate and seek out the potential problem. If abnormal injuries continue to occur for three consecutive days, systematic releases of test fish will be made near the downstream end of the system continuing upstream until the problem is located. If problem areas (i.e. debris blockages) are not found, then NMFS and the MCCC (to the extent possible) will be consulted to determine appropriate actions, which may include shutting down the system for a more intrusive investigation.

### ***3.4.9.2. Adults***

#### ***Fallback or Dropback***

If, during operations of the system, fallback/dropback rates increase by 25 percentage points

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when compared to pre-construction measurements, Chelan PUD will consult with NMFS and the MCCC to determine appropriate actions.

### ***Delay***

If, during operations of the system, mean passage times increase by more than 2 days when compared to pre-construction measurements, Chelan PUD will consult with NMFS and the MCCC to determine appropriate actions.

## **3.5. Other Measures to Improve Project Survival**

### **3.5.1. Predator Control Measures**

Chelan PUD proposes to refine and implement a comprehensive predator removal and harassment program for the protection of juvenile UCR spring chinook salmon and steelhead. For northern pikeminnows, activities should be similar to those measures considered in NMFS' 1998 biological opinion on the Department of Agriculture's Northern Squawfish Removal Program at Rocky Reach and Rock Island Dams (NMFS 1998c) and may include, but not be limited to angling and long-line fisheries and a sport fishing derby in the project area. For piscivorous birds (caspians terns, double-crested cormorants, and various gull species), activities may include, but not be limited to foraging deterrents (e.g., steel wires in the RRE tailrace), hazing, and lethal removal of individual birds - actions considered in NMFS' 2000 FCRPS biological opinion. These programs will continue to run during the juvenile outmigration.

## **3.6. Studies to Assess Juvenile Passage and Survival**

In 2003, during the first year of operation for the JBS, Chelan PUD proposes to conduct a study to determine fish passage efficiency through all routes of passage. Based on these results, project operations (spill percentages) will be set for years 2004-2006.

Beginning in 2004, Chelan PUD proposes to use acoustic tag technology to measure Juvenile Dam Passage Survival (JDPS) and Juvenile Project Survival (JPS) on yearling chinook and steelhead. The ongoing effort to design and develop acoustic tag survival methodology is being done cooperatively with consultants, the NMFS Science Center, and the USGS Biological Research Division.

Chelan PUD proposes to conduct studies between 2004 and 2006 to determine if these operations result in JDPS which meets or exceeds 95% or JPS which meets or exceeds 93% for UCR spring chinook salmon and steelhead.<sup>8</sup> As noted previously in Section 3.1, Chelan PUD proposes to meet these juvenile survival standards for these ESUs and will implement additional measures, if deemed effective and necessary, to accomplish this objective.

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<sup>8</sup> These juvenile survival standards are set forth in the most recent HCP documents.

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### **4. BIOLOGICAL INFORMATION**

Two anadromous fish species are currently protected under the ESA within the action area. UCR steelhead and UCR Spring chinook salmon and were listed as endangered on August 18, 1997 (62 FR 43937) and March 24, 1999 (64 FR 14308), respectively.

The biological requirements, life histories, migration timing, historic abundance, and factors contributing to the decline of Snake River salmon and steelhead have been well documented (BA, Busby et al. 1996, Myers et al. 1998, NMFS 1995, 1996, 1997, 1998a, 1998b, 2000a, and 2000b). The following sections briefly describe relevant biological information for UCR spring chinook salmon and steelhead.

#### **4.1. UCR Spring Chinook Salmon**

##### **4.1.1. Geographic Boundaries and Spatial Distribution**

This ESU includes spring-run chinook populations found in Columbia River tributaries between the Rock Island and Chief Joseph dams, notably the Wenatchee, Entiat, and Methow River basins. The populations are genetically and ecologically separate from the summer- and fall-run populations in the lower parts of many of the same river systems (Myers et al. 1998). Although fish in this ESU are genetically similar to spring chinook in adjacent ESUs (i.e., mid-Columbia and Snake), they are distinguished by ecological differences in spawning and rearing habitat preferences. For example, spring-run chinook in upper Columbia tributaries spawn at lower elevations (500 to 1,000 m) than in the Snake and John Day River systems. Chinook salmon (and their progeny) from the following stocks that are raised in hatcheries and are considered part of the listed ESU: Chiwawa River (spring run); Methow River (spring run); Twisp River (spring run); Chewuch River (spring run); White River (spring run); and Nason Creek (spring run).

##### **4.1.2. Historical Information**

The upper Columbia River populations were intermixed during the Grand Coulee Fish Maintenance Project (1939 through 1943), resulting in loss of genetic diversity between populations in the ESU. Homogenization remains an important feature of the ESU. Fish abundance has trended downward both recently and over the long term. At least six former populations from this ESU are now extinct, and nearly all extant populations have fewer than 100 wild spawners.

##### **4.1.3. Life History (Including Ocean)**

UCR spring chinook are considered stream-type fish, with smolts migrating as yearlings. Most stream-type fish mature at 4 years of age. Few coded-wire tags are recovered in ocean fisheries,

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suggesting that the fish move quickly out of the north central Pacific and do not migrate along the coast. Details can be found in Myers et al. (1998) and Chapman et al. (1995).

### **4.1.4. Population Trends and Risks**

For the UCR spring chinook salmon ESU as a whole, NMFS estimates that the median population growth rate ( $\lambda$ ) over the base period<sup>9</sup> ranges from 0.84 to 0.85, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Appendix A; McClure et al. 2000). NMFS has also estimated median population growth rates and the risk of absolute extinction for the three spawning populations identified by Ford et al. (1999), using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from 0.97 for the Methow River to 1.00 for the Methow and Entiat rivers (Table B-5 in McClure et al. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of extinction within 100 years is 1.00 for all three spawning populations (Table B-6 in McClure et al. 2000).<sup>10</sup>

NMFS has also used population risk assessments for UCR spring chinook salmon and steelhead ESUs from the draft QAR (Appendix A, NMFS 2000a, NMFS 2000b). Risk assessments described in that report were based on Monte Carlo simulations with simple spawner/spawner models that incorporate estimated smolt carrying capacity. Population dynamics were simulated for three separate spawning populations in the UCR spring chinook salmon ESU, the Wenatchee, Entiat, and Methow populations. The QAR assessments showed extinction risks for UCR spring chinook salmon of 50% for the Methow, 98% for the Wenatchee, and 99% for the Entiat spawning populations. These estimates are based on the assumption that the median return rate for the 1980 brood year to the 1994 brood year series will continue into the future.

## **4.2. UCR Steelhead**

### **4.2.1. Geographic Boundaries and Spatial Distribution**

This ESU occupies the Columbia River basin upstream of the Yakima River to Chief Joseph

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<sup>9</sup> Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1998 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

<sup>10</sup> NMFS is citing the draft QAR throughout this document and utilizes the risk assumptions for only one of three time frames evaluated in the draft QAR. The QAR or the appropriate time frame may change once the QAR is finalized, and once NMFS completes its review of salmon listing decisions and hatchery policies (67 Fed. Reg. - February 11, 2002).

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Dam. Rivers in the area primarily drain the east slope of the northern Cascade Mountains and include the Wenatchee, Entiat, Methow, and Okanogan River basins. The climate of the area reaches temperature and precipitation extremes; most precipitation falls as mountain snow (Mullan et al. 1992b). The river valleys are deeply dissected and maintain low gradients, except for the extreme headwaters (Franklin and Dyrness 1973).

### **4.2.2. Historical Information**

Estimates of historical (pre-1960s) abundance specific to this ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a pre-fishery run size exceeding 5,000 adults for tributaries above Rock Island Dam (Chapman et al. 1994). Runs may, however, already have been depressed by lower Columbia River fisheries.

### **4.2.3. Life History**

As in other inland ESUs (the Snake and mid-Columbia River basins), steelhead in the Upper Columbia River ESU remain in freshwater up to a year before spawning. Smolt age is dominated by 2- and 3-year-olds. Based on limited data, steelhead from the Wenatchee and Entiat rivers return to freshwater after 1 year in salt water, whereas Methow River steelhead are primarily age-2-ocean (Howell et al. 1985). Life history characteristics for UCR steelhead are similar to those of other inland steelhead ESUs; however, some of the oldest smolt ages for steelhead, up to 7 years, are reported from this ESU. The relationship between anadromous and non-anadromous forms in the geographic area is unclear. Details can be found in Busby et al. (1996) and Chapman et al. (1994).

### **4.2.4. Population Trends and Risks**

The return of UCR natural-origin steelhead to Priest Rapids Dam declined from a 5-year average of 2,700 beginning in 1986 to a 5-year average of 900 beginning in 1994 (FPC 1998). The WDFW has set an escapement goal for natural-origin fish of 4,500.

For the UCR steelhead ESU as a whole, NMFS estimates that the median population growth rate ( $\lambda$ ) over the base period<sup>11</sup> ranges from 0.69 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Appendix A; Tables B-2a and B-2b in McClure et al. 2000). NMFS has also estimated the risk of absolute extinction for the aggregate UCR steelhead population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute

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<sup>11</sup> Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1996 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

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extinction within 100 years is 0.25 (Table B-5 in McClure et al. 2000). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 (Table B-6 in McClure et al. 2000).

Because of data limitations, the draft QAR steelhead assessments in Cooney (NMFS 2000b) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for wild UCR steelhead is 100%. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35% for the Wenatchee/Entiat and 28% for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100% were projected for both populations.

### **4.3. Significant Factors Influencing Range-wide Status of Each ESU**

#### **4.3.1. Harvest**

Overall recent harvest rates for UCR spring chinook and UCR steelhead are approximately 10% (NMFS 2000b).

#### **4.3.2. Hatcheries**

##### ***UCR Spring Chinook***

Spring-run chinook salmon from the Carson National Fish Hatchery (a large composite, non-native stock) were introduced into and have been released from local hatcheries (Leavenworth, Entiat, and Winthrop National Fish Hatcheries [NFH]). Little evidence suggests that these hatchery fish stray into wild areas or hybridize with naturally spawning populations. In addition to these national production hatcheries, two supplementation hatcheries are operated by the WDFW in this ESU. The Methow Fish Hatchery Complex (operations began in 1992) and the Rock Island Fish Hatchery Complex (operations began in 1989) were both designed to implement supplementation programs for naturally spawning populations on the Methow and Wenatchee rivers, respectively (Chapman et al. 1995).

Risks associated with artificial production programs within the ESU are a concern because of the use of non-native Carson stock for fishery enhancement and hydropower mitigation. However, programs have been initiated to develop locally-adapted brood stocks to supplement the natural populations in the ESU. The Carson stock is being phased out at those facilities where straying and natural stock interactions are problematic. Captive broodstock programs are under way in the Nason Creek and the White River (the Wenatchee basin) and in the Twisp River (Methow basin), to prevent those populations from going extinct. In some recent years, all spring chinook

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salmon have been trapped at the Wells Hydroelectric Project to begin a composite-stock broodstock supplementation program for the Methow Basin.

### ***UCR Steelhead***

The naturally-spawning population of UCR steelhead has been augmented for a number of years by straying hatchery fish. Replacement ratios for naturally-spawning fish (natural-origin and hatchery strays) are quite low, on the order of 0.3. This very low return rate suggests that either hatchery strays are largely supporting the population, or that hatchery strays are not contributing substantially to subsequent adult returns and natural-origin fish are returning at or just below the replacement rate, or some intermediate combination of these factors. Given these uncertainties, efforts are underway to diversify broodstocks used for supplementation, minimizing the differences between hatchery and natural-origin fish as well as other concerns associated with supplementation. Assuming that the hatchery broodstock represents the listed ESU, NMFS expects that the early life history survival advantage of hatchery smolts will help stocks to rebuild. However, there are also substantive concerns about the long term effect on the fitness of natural-origin populations resulting from an ongoing, long term infusion of hatchery-influenced spawners (Busby *et al.* 1996).

The hatchery component is relatively abundant and routinely exceeds the needs of the supplementation program by a substantial margin. NMFS is currently developing new hatchery policies to guide how hatchery fish will be considered in future status reviews and listing decisions. NMFS expects that hatchery policy will be finalized and a new review of the UCR steelhead ESU will be completed in 2002.

### **4.3.3. Hydropower**

The Grand Coulee Fish Maintenance Project (1939 through 1943) may have been a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the Upper Columbia Region.

The remaining four FERC-licensed Mid-Columbia River hydroelectric projects (Wells, Rock Island, Wanapum and Priest Rapids) affect the mainstem migration corridor and reduce survival of juvenile and adult migrants. Consultation with FERC on the Wanapum and Priest Rapids projects is occurring contemporaneously with this consultation, and the actions under consultation will affect UCR spring chinook salmon. Consultation on interim operation of the Wells project was completed on June 19, 2000. Each of these license requirements and settlement agreements specify specific actions intended to reduce the effects of project operations on anadromous salmonids.

Similarly, operation of the four Federal Columbia River Hydroelectric System (FCRPS) projects (Bonneville, The Dalles, John Day and McNary dams) in the lower Columbia River also affects the migration corridor for these species. The December 21, 2000, biological opinion regarding

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operation of these projects identified current incidental mortality rates of 43% for juveniles and 9% for adults. The 2000 FCRPS Biological Opinion specifies that these will be reduced to 34% and 8%, respectively, by 2010. Additional measures identified in the 2000 FCRPS Biological Opinion's Reasonable and Prudent Alternative (RPA) will improve the survival of UCR spring chinook salmon by funding offsite mitigation activities (e.g., habitat restoration) affecting other portions of their life-history (NMFS 2000a).

### **4.3.4. Habitat**

Spawning and rearing habitat in the Columbia River and its tributaries upstream of the Yakima River includes dry areas where conditions are less conducive to salmon and steelhead survival than in many other parts of the Columbia basin (Mullan et al. 1992a). Salmon in this ESU must pass up to nine Federal and non-Federal dams, and Chief Joseph Dam prevents access to historical spawning grounds farther upstream. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects, and livestock grazing along riparian corridors. Details of tributary habitat problems and potential solutions for these ESUs are in NMFS et al. (1998).

NMFS is currently reviewing critical habitat designations for UCR spring chinook salmon and steelhead. NMFS expects that this review will be completed in 2002.

### **4.4. Species-Level Biological Requirements**

Species-level biological requirements are best defined as the attributes associated with viable salmonid populations (McElhany et al. 2000). Viable salmonid populations have a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame. The attributes associated with viable salmonid populations include: adequate abundance, productivity (population growth rate), population spatial scale, and diversity. These attributes are influenced by survival, behavior and experiences throughout the entire life cycle, and are therefore distinguished from the more specific biological requirements associated with the action area (described in Section 5) and the particular action under consultation. Species-level biological requirements are influenced by all actions affecting the species throughout its life cycle. It is important that the action-area biological requirements be considered in the context of these species-level biological requirements in order to evaluate the potential for the species to survive and recover given the comprehensive set of human activities and environmental conditions that are affecting it.

By definition, most populations comprising listed species are not viable. Listed species will be

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considered recovered<sup>12</sup> when, among other things, factors for decline have been ameliorated and when a sufficient number of populations within the ESU have become viable. For the purpose of assessing the effects of the proposed actions while listed ESUs and their component populations are moving towards recovery, NMFS has defined the degree to which species-level biological requirements must be met primarily in terms of abundance (NMFS 1995a [1995 FCRPS Biological Opinion]):

“At the species level, NMFS considers that the biological requirements for survival, with an adequate potential for recovery, are met when there is a high likelihood that the species’ population will remain above critical escapement thresholds over a sufficiently long period of time. Additionally, the species must have a moderate to high likelihood that its population will achieve its recovery level within an adequate period of time. The particular thresholds, recovery levels, and time periods must be selected depending upon the characteristics and circumstances of each salmon species under consultation.”

This definition implicitly addresses the productivity criterion for viable populations because population growth rate must increase to reach critical threshold or recovery abundance levels from current low abundance levels, within an adequate time period. For ESUs with multiple populations, the spatial scale and diversity criteria for viable populations are addressed primarily by specifying the number of populations that must meet species-level biological requirements, as defined above. This is considered on an ESU-by-ESU basis, depending upon the degree to which populations, and their relation to one other within an ESU, have been delineated and the degree to which a mixture of populations within an ESU is required to maintain long-term evolutionary potential including survival in the face of catastrophic events and other long-term demographic processes (McElhany et al. 2000). This information is poorly developed for most ESUs at present, therefore, where information to the contrary is absent, NMFS will assume that all populations within an ESU must meet the species-level biological requirements described above in order to conclude that the entire ESU is meeting those biological requirements.

### 4.5. Species Status With Respect to Species-Level Biological Requirements

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<sup>12</sup> The regulatory terms "survival" and "recovery" are defined for use in the jeopardy/critical habitat analysis as follows:

Survival: The species' persistence, as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter.

Recovery: improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act. [50 CFR '402.02] "

(NMFS and FWS, *Section 7 Endangered Species Consultation Handbook -- Procedures for Conducting Section 7 Consultations and Conferences, March 1998*) (hereafter "the Consultation Handbook").

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The current status of each species, as described in Sections 4.1 - 4.3, indicates that the species-level biological requirements described in Section 4.4 are most likely not being met. At present, NMFS' best quantitative estimates of the median annual population growth rates ( $\lambda$ ) range from 0.80 to 0.92 for UCR spring chinook salmon and 0.69 to 0.97 for UCR steelhead NMFS 2000a.<sup>13</sup> The 2000 FCRPS Biological Opinion concluded that survival improvements expected from: (1) changes in Federal hydrosystem configuration and operation; (2) offsite mitigation provided by the FCRPS operating agencies; (3) achievement of survival goals at FERC-licensed projects as described in the proposed RRE HCP; and (4) other background survival improvements anticipated in the Basinwide Recovery Strategy would be sufficient to provide a high likelihood of survival and a moderate-to-high likelihood of recovery. However, these survival improvements have not yet been achieved. Taken together, this information clearly indicates that improvements in survival rates (assessed over the entire life cycle) are necessary to meet species-level biological requirements in the future.

### **4.6. Critical Habitat**

Critical habitat was designated for both UCR spring chinook salmon and UCR steelhead on February 16, 2000 (65 FR 7764). Relevant elements of critical habitat are described under the environmental baseline. Critical habitat designations for UCR spring chinook salmon and steelhead are being reviewed by NMFS in 2002.

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<sup>13</sup> Lambda equal to 1.00 indicates that a population is in equilibrium, neither increasing or declining. Lambdas less than 1.00 indicate that a population is declining. Conversely, lambdas greater than 1.00 indicate that a population is increasing.

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### **5. ENVIRONMENTAL BASELINE**

#### **5.1. Description of the Action Area**

The action area includes all areas affected directly or indirectly by the Federal action [50 CFR section 402.02]. Based on this definition, the action area relevant to UCR Spring chinook salmon and steelhead is defined as the mainstem Columbia River from the furthest downstream point to the furthest upstream point at which these species are affected by the FERC-licensed project under consideration. For the purposes of this biological opinion, the action area relative to Juvenile Bypass System construction and operation and project operations for UCR Spring chinook salmon and steelhead is defined as the mainstem Columbia River from the Wells Dam tailrace downstream to the Odabashin Bridge (approximately 4 miles downstream of the RRE project) a total distance of approximately 46 miles.<sup>14</sup>

#### **5.2. Biological Requirements Within the Action Area**

Within the action area, the biological requirements of UCR Spring chinook salmon and steelhead are very similar to those of other salmonids in the Snake River and lower Columbia River migration corridors. These biological requirements stem from the essential features of juvenile rearing areas and juvenile and adult migration corridors, as described in the critical habitat designation for Snake River spring/summer chinook salmon, fall chinook salmon, and sockeye salmon (58 FR 68543). Therefore, the biological requirements for UCR Spring chinook salmon and steelhead include adequate substrate, adequate water quality (including quantity, temperature and velocity), adequate cover and shelter, adequate riparian vegetation, adequate space, and adequate conditions for safe passage. In addition, an adequate food supply is required in juvenile rearing areas.

Defining a level of ‘adequacy’ through specific, measurable standards for many of these biological requirements is problematic. In many cases, the absolute relationship between the critical element and species survival is not clearly understood, thus limiting NMFS’ ability to develop specific, measurable standards. However, some parameters established in the 2000 FCRPS (Federal Columbia River Power System) Biological Opinion will be utilized in this Biological opinion to assist in analyzing and developing specific operational measures. The 120 percent total dissolved gas (TDG) limit on spill for juvenile passage at mainstem hydroelectric projects and the 135 kcfs minimum spring flow objective at Priest Rapids Dam serve as two examples NMFS 2000a.

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<sup>14</sup> Project effects on water quality parameters (temperature and total dissolved gas) are cumulative in nature and thus must appropriately be considered in a broader context. Currently, EPA and the Washington and Oregon Departments of Environmental Quality, in consultation with NMFS, are evaluating these standards in the mainstem mainstem Snake and Columbia Rivers and will allocate loads to meet those standards in the near future.

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Additionally, most of the effects of the proposed action on the elements of critical habitat are captured in a summary reach survival statistic (Section 6.1.1). Adequacy of reach survival in the action area has been determined through life-cycle analyses in the 2000 FCRPS Biological Opinion and allocations of survival improvements in the Basinwide Salmon Recovery Strategy (Section 6.1.2). Thus, action-area biological requirements can be defined as achieving the juvenile and adult survival standards described in the proposed HCP and in Section 3.5.<sup>15</sup> These requirements are: Juvenile Dam Passage Survival (JDPS) of at least 95% or Juvenile Project Survival (JPS) of at least 93% or Combined Adult and Juvenile Project Survival of at least 91% (equates to an adult passage survival of 98% if the JPS standard of 93% is being met).

### **5.3. Factors Affecting Species' Environment Within the Action Area**

Operation of the Rocky Reach project is a critical factor influencing survival in the action area. Although the action area described in Section 5.1 only encompasses a small part of the species' range, up to 100% of the juvenile and adult populations may be affected by a continuation of the human activities that contributed to the existing conditions in the migration corridor. Mortality and sublethal effects (e.g., changes in migration timing or speed) associated with river impoundments, dam passage, and other aspects of project operations within the action area in recent years are described in Section 6.

Operation of the Federal Columbia River Hydroelectric System (FCRPS) also affects the migration corridor in the action area for these species. For example, a spring flow objective of 135 kcfs, as measured at Priest Rapids Dam, was established for steelhead migrating in the Columbia River upstream of McNary Dam in the 1998 FCRPS Supplemental Biological Opinion (NMFS 1998). Additional measures identified in the 2000 FCRPS Biological Opinion's Reasonable and Prudent Alternative (RPA) will increase the likelihood that the flow objective will be achieved and improve the survival of UCR spring chinook salmon and UCR steelhead through other portions of their life-history NMFS 2000a.

Where it occurs, runoff from surrounding agricultural and urban centers and loss of riparian vegetation on private lands may effect water quality, and thus influence survival, in the action area.

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<sup>15</sup> In order to ensure that the potential effects of the juvenile bypass system construction activities are fully captured, the action area considered in this biological opinion is slightly larger than the RRE project area defined in the proposed HCP (the tailrace of the Wells Hydroelectric Project to the RRE project tailrace, approximately 1000 feet downstream of the dam). Future studies relating to "project survival" etc., will be based on the HCP definition of the project. For the purposes of this consultation and proposed studies to assess survival, the differences between these two definitions (roughly 4 miles) is likely negligible.

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### **5.4. Status of the Species Within the Action Area**

The past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all the proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impacts of State or private actions that are contemporaneous with the consultation in process are all included within the environmental baseline [50 CFR section 402.02]. The environmental baseline encompasses the effects of both human and natural factors leading to the current status of the species, but does not incorporate impacts specific to the proposed actions. Therefore, future impacts resulting from the continued operation of the Rocky reach Hydroelectric Project and other activities authorized pursuant to the proposed actions are not included in the environmental baseline. Rather, the environmental baseline describes the current status of the species, and the factors currently affecting the species environment, within the action area. The resulting “snapshot” of the species’ health within the action area provides the relevant context for evaluating the anticipated effects of the proposed actions on the current and future status of the ESU.

These effects have influenced the current status of listed species, which as described in Section 4, does not meet species-level biological requirements. Maintenance or further degradation of the existing conditions within the action area would contribute to the current declining trend and thus would continue to increase the high risk of extinction on which the listings were based. Measures must be taken at the Rocky Reach Hydroelectric Project to avoid ongoing impacts that have contributed to the trend towards extinction and to aid in establishing improved conditions whereby each species will continue to exist into the future while retaining the potential for recovery. The successful implementation of these measures at the Rocky Reach Hydroelectric Project will be necessary for the proposed action to avoid jeopardizing listed species.

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### **6. EFFECTS OF PROPOSED ACTION**

#### **6.1. Analytical Methods**

In this section NMFS evaluates the effects of the proposed action using the five-part approach for applying the ESA jeopardy standard to Pacific salmon as developed in the 1995 FCRPS Biological Opinion, the 1998 Supplemental FCRPS Biological Opinion, and the 2000 FCRPS Biological Opinion. The analysis involves the following steps:

1. Define the biological requirements of the listed species (Sections 4 and 5).
2. Evaluate the relevance of the environmental baseline to the species' current status (Section 5).
3. Determine the effects of the proposed or continuing action on listed species (methods described and applied in Section 6).
4. Determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the environmental baseline and any cumulative effects, and considering measures for survival and recovery specific to other life stages (Section 6).
5. Identify reasonable and prudent alternatives to a proposed or continuing action that is likely to jeopardize the continued existence of the listed species.<sup>16</sup>

##### **6.1.1. Methods for Evaluating Effects on Action-Area Biological Requirements**

During this step of the analysis, effects of the action are evaluated with respect to action-area biological requirements. The general considerations are discussed here, and a more detailed analysis is included in Section 6.2.

The primary approach to evaluating effects in the action area is to estimate juvenile and adult survival rates associated with the proposed action. Both direct and indirect (delayed) mortality are estimated to the extent possible. These survival rates should capture most, but not necessarily all, of the impacts associated with meeting action-area biological requirements.

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<sup>16</sup> This step is relevant only when the conclusion of the previously-described analysis is that the proposed action will jeopardize listed species. The reasonable and prudent alternative would have to reduce mortality associated with the proposed action to a level that does not jeopardize the species. An analysis to determine sufficiency of the reasonable and prudent alternative will be based on the same considerations described above.

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- **Adequate Substrate and Adequate Food Supply for Juveniles:** The impoundment of the Rocky Reach Project reservoir by the Rocky Reach Dam has probably changed the characteristics of substrate above Rocky Reach Dam from gravel and cobble to finer sediment size. However, this change in substrate is unlikely to affect adults or early life stages of the species subject to this consultation because both UCR steelhead and UCR spring chinook salmon are tributary spawners. It is possible that the change in substrate has influenced food production, possibly reducing feeding success and growth of smolts migrating through the impounded reach. However, evidence for this effect is speculative at present (ISG 1996, Chapter 6). If such an effect occurs, it is likely to be captured in either the direct survival or indirect mortality rates estimated later in this section. The presence of the Rocky Reach Dam may also decrease gravel recruitment to downstream reaches. This later effect would be most likely to influence the spawning success of Mid-Columbia River mainstem spawning species, but would have little or no effect on UCR spring chinook salmon or steelhead.
- **Adequate Water Quality:** The primary characteristics of water quality affected by operations of the Rocky Reach Hydroelectric Project are total dissolved gas levels and temperature.
- **Adequate Cover and Shelter:** Impoundment of the Rocky Reach Project reservoir has modified the physiographic complexity of this reach compared to conditions in a free-flowing river, resulting in a modification of cover and shelter and a potential change in predation on juveniles of listed species. This effect would presumably be observable in estimates of juvenile survival, which are the focus of our approach to evaluating effects (Section 6.2). Additionally, the PUD has proposed a program to remove predators from areas where juveniles are most vulnerable to predation.
- **Adequate Riparian Vegetation:** Impoundments have likely changed the riparian vegetation within the study reach from pre-impoundment conditions. Regulation of the Rocky Reach Hydroelectric Project reservoir elevation may influence the distribution and composition of riparian vegetation in the study area. Riparian vegetation is likely to influence cover, food production, temperature, and substrate, so the primary effects are addressed with respect to other factors. Additionally, effects of changes in riparian vegetation resulting from the proposed action are likely to be expressed in the survival rates of juveniles and adults (Section 6.2).
- **Adequate Space and Conditions For Safe Passage:** The configuration of the Rocky Reach Dam and the proposed operation of the Rocky Reach Hydroelectric Project primarily affect the safe passage of juveniles and adults through the action area (Section 6.2). The proposed action is designed to materially improve long-term juvenile passage and survival at the dam.

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### **6.1.2 Methods for Evaluating Effects on Species-Level Biological Requirements**

The effects of the proposed action on the species-level biological requirements can be evaluated using an analysis that combines expected survival through the action area, as described in Section 6.2, with expected survival through other life stages to determine if there is a high likelihood of survival and a moderate to high likelihood of recovery. Such an analysis has been completed and is described in the December 21, 2000, Federal Columbia River Power System (FCRPS) Biological Opinion. Briefly, that analysis determined that species-level biological requirements of UCR spring chinook salmon and steelhead can be met through a combination of: (1) Federal improvements in survival past lower Columbia River dams; (2) Federal improvements as described in RPA Actions 1-148 in estuary and tributary habitat affecting these ESUs as described in RPA Actions 149-199; and (3) improvements made at Douglas, Chelan, and Grant County PUDs' mid-Columbia projects to meet survival standards described in the draft HCP.<sup>17</sup> Therefore, meeting survival standards at the RRE project should be sufficient for meeting species-level biological requirements, given Federal actions in the environmental baseline.

Because the relevant life-cycle analysis has already been conducted, this biological opinion will evaluate expected survival within the action area (Section 6.2) and compare the results with HCP criteria to determine if species-level biological requirements are likely to be met.

### **6.2. Effects on UCR Spring Chinook Salmon and Steelhead**

This biological opinion analyzes the effects of the proposed action (the construction and operation of the new juvenile bypass system, RRE project operations, and predator control measures) to minimize or mitigate for those effects on ESA listed UCR spring chinook salmon and steelhead. This biological opinion does not analyze the effects of hatcheries funded by Chelan PUD, which are being addressed in other on-going NMFS consultations, nor does it analyze the effects of operating the juvenile bypass system sampling facility (see Section 3.4.8), which is already considered to be part of the environmental baseline (these effects have already been considered in a section 10 permit and associated biological opinion).

The effects of other FERC-licensed projects in the mid-Columbia on UCR spring chinook salmon and steelhead have either already been (as is the case with Douglas County PUD's Wells Dam) considered, in which case these effects are already included in the environmental baseline; or soon will be considered in separate biological opinions (as is the case with Chelan PUD's

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<sup>17</sup> FERC has already consulted with NMFS on the effect of Douglas County PUD's Wells Hydroelectric Project and is currently consulting with NMFS on the effect of Grant County PUD's Priest Rapids Hydroelectric Project (Wanapum and Priest Rapids dams). NMFS expects that FERC will initiate consultation on the effects of Chelan PUD's Rock Island Hydroelectric Project in response to the Rock Island HCP filing.

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Rock Island Dam and Grant County PUD's Wanapum and Priest Rapids dams).

### **6.2.1. General Considerations Relating to the Effects of the RRE Project and Operations on Salmonid Migration and Survival**

UCR spring chinook salmon and steelhead from the Methow and Okanogan rivers must pass through the Rocky Reach Hydroelectric Project as well as four other PUD-owned projects during their migrations to and from the Pacific Ocean. Entiat River spring chinook salmon and steelhead must pass through the RRE project as well as three other PUD-owned projects and Wenatchee River spring chinook salmon and steelhead do not have to pass through the RRE project, but some adults may overshoot the Wenatchee River and pass upstream of RRE Dam. In addition to the PUD-owned projects, all of the fish from these basins must pass four Federally-owned projects in the lower Columbia River during their migrations to and from the Pacific Ocean.

As discussed in greater detail in the following sections, the presence of RRE may result in migration delay, thereby influencing migration speed and timing for both juvenile and adult salmon and steelhead. Additionally, a significant rate of juvenile injury and mortality occurs during their downstream passage through the reservoir and dam. Although the direct mortality of adults is likely minimal during upstream passage at RRE dam, cumulatively delays caused by all of the mainstem dams present the potential for delays at fishway facilities, increased rates of energy expenditure in multiple fishways, increased incidence of involuntary fallback through the dam, and increased exposure to high concentrations of dissolved gases. Additionally, a small percentage of adults may fail to enter project fishways and pass upstream. This could be due to a fish's inability to detect fishway entrances or due to the lack of distinguishable environmental cues inducing fish to continue upstream past the project. As a result of these indirect effects, a component of the adult populations may fail to successfully spawn.

The hydropower system may also positively affect some aspects of the upstream migration. For example, travel time and energy expenditures of the upstream migrants are reduced in reservoirs relative to free flowing rivers. However, the true direction and magnitude of the effects, with respect to the cumulative effects on adult passage, are unknown.

As discussed in Section 6.1, the primary method for evaluating the effects of the proposed action on the biological requirements of listed species in the action area is through analyses of survival. At the RRE project, the survival of UCR spring chinook salmon and steelhead is most affected by the effects of:

- Project operations on juvenile salmonid passage, including passage through the proposed Juvenile Fish Bypass system, spill, and turbines;
- project operations on adult salmonid passage;
- project operations on water quality;

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- the project reservoir; and
- the predator control program.

The survival of juvenile salmonids was first assessed in 1982 and 1983 (McKenzie *et al.* 1983, 1984) although dam-specific estimates were not calculated. Additional evaluations were attempted in 1985 and 1986 by the Fish Passage Center, but the information collected is considered to be unusable due to significant problems experienced during execution of the study.

Eppard *et al.* (1999) conducted a pilot level PIT (Passive Integrated Transponder) tag study in 1998 to assess the total project survival of hatchery reared, yearling, summer/fall chinook salmon at the RRE Project.

Douglas County PUD also conducted PIT-tag survival evaluations in 1998, 1999, and 2000 utilizing hatchery reared juvenile spring chinook salmon (1998) and steelhead (1999 and 2000) (Bickford *et al.* 1999, 2000, and 2001). These studies generated estimates of survival from the Wells Hydroelectric Project tailrace to the PIT-tag detectors at the RRE Project.

In 1999, LGL Limited utilized similar methodologies to evaluate the survival of juvenile hatchery reared steelhead at the RRE Project (Stevenson *et al.* 2000). Stevenson *et al.* (2000) also conducted a pilot level radio-telemetry study in 1999, using juvenile steelhead to estimate survival. Even though the confidence intervals established in the radio-telemetry evaluation were comparatively poor, the study parameters were met, and no significant differences between the PIT-tagged and radio-tagged fish were detected within the parameters tested.

However, utilizing radio-telemetry to assess survival is considered experimental. It is unclear at this time, for example, if the behavior of radio-tagged and PIT-tagged fish is comparable (i.e., similar passage route preferences, similar run timing, etc.), and therefore unclear if the survival estimates determined for each group actually represents survival under similar conditions or survival representative of the general population. Additional tests are currently underway to help resolve these issues for future studies.

More recently, Chelan PUD has been working cooperatively with NMFS' Science Center and others to develop and utilize acoustic tags to estimate survival at their projects. While this technology has several advantages compared to radio-tags for assessing survival, it is also considered experimental at this time. At this time NMFS believes that, compared to radio-tag or acoustic-tag studies, PIT-tag studies provide the most accurate and robust estimate of juvenile survival through hydroelectric projects (reservoir and dam).

There is very little data available to assess the survival of adult spring chinook salmon and steelhead for the RRE project. Radio-telemetry evaluations conducted between 1993 and 1997 contain the bulk of the available information, although survival was not specifically addressed in any of these studies (Stuehrenberg *et al.* 1995; English *et al.* 1998). Radio-tagged adult

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migrants that were not detected in known spawning areas may be an indication of pre-spawning mortality. However, adults spawning in unknown areas, regurgitated tags or unknown harvest rates could all bias estimates of pre-spawning mortality associated with the hydroelectric projects. Excessive delay reported at fishway entrances and fallback over dams are the most pronounced problems that adults experience in their upstream migrations that can be assessed using radio-telemetry techniques. Therefore, past evaluations have focused largely on defining these issues. The lack of adequate adult survival information, significantly increases the level of uncertainty associated with the analyses contained in this biological opinion.

The importance of steelhead kelts (adults that have spawned and are migrating downstream to the ocean) to inland populations of steelhead in the Columbia River basin is receiving greater attention in recent years. The proportion of adults that spawn and migrate to the ocean as kelts is much higher than previously thought. English et al. (2001) estimated that between 13% to 75% of the adult steelhead migrating upstream of Rocky Reach Dam in 1999 began migrating downstream as kelts in 2000.

In the Snake River, Evans (2002) estimated that the proportion of wild adult steelhead attempting to outmigrate as kelts in 2001 was at least 25% of the ESA-listed adults migrating past Lower Granite Dam in 2000. The majority of these fish (> 70%) were considered to be in good condition. Most importantly, the ratio of female to male kelts appears to be very high; for example, at McNary Dam in 2001 the female to male ratio was 11:1 (Worthheimer, pers. comm. 2002). Unfortunately, few steelhead kelts are able to survive the migration to the ocean and back to their natal streams. Only 3% (7 / 212) of the kelts radio-tagged at Lower Granite Dam on the Snake River were detected at Bonneville Dam in 2001 (Evans 2002). While the historical importance of adult steelhead spawning multiple times on the UCR steelhead ESU is not well understood, should these fish successfully survive the mainstem Columbia River migration corridor and the ocean environment, they could significantly enhance the reproductive capabilities of the UCR steelhead population.<sup>18</sup>

### **6.2.2. Effects of the RRE Project and Operations on Juvenile Passage and Survival**

#### **6.2.2.1. General Considerations**

Juvenile salmon and steelhead pass the RRE dam through various routes including turbines, bypass systems, and spillways. Some juvenile mortality is associated with all dam passage routes although the highest levels of mortality typically occur during passage through turbines (Whitney *et al.* 1997). Therefore, to increase survival, an important objective of project operations is to route the highest possible proportion of juveniles past the project in a manner that avoids passage through turbines. The proportion of smolts that pass a project through

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<sup>18</sup> However, it should be noted that, based on scale analysis, repeat spawning of summer-run steelhead in the Columbia River was never very high. Long and Griffin (1937) estimated that only 2% of the summer-run fish were repeat spawners, which comports well with the findings of McGregor (1986) in the Thompson River basin.

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bypasses or over spillways is an important indicator of the effectiveness of fish passage protection measures.

### ***Juvenile Passage Through Turbines***

Juvenile salmonid turbine passage survival studies published through 1990 at the Snake and lower Columbia River dams have been reviewed by Iwamoto and Williams (1993). The Independent Scientific Group (ISG 1996) and Whitney *et al.* (1997) reviewed studies published through 1995, including several from the Mid-Columbia River projects. Turbine mortality has been estimated primarily for juvenile salmon, although at least two studies have estimated steelhead mortality (Weitkamp *et al.* 1986; Olson and Kaczynski 1980). Estimates of turbine mortality vary greatly among studies, ranging from 2.3% to 19%. Whitney *et al.* (1997) pointed out that in studies where marked fish were immediately recovered in the tailrace, mortality estimates were less than seven percent (average 5.5%). In studies with longer times between turbine passage and recovery, mortality levels averaged 10.9% (Whitney *et al.* 1997). Whitney *et al.* (1997) also suggested that the lower survival estimates likely included some level of mortality not directly associated with turbine passage such as predation on disoriented smolts.

In recent years, evaluations of the direct and indirect effects of juvenile fish passage through Kaplan-type turbines were conducted under operations presumed to provide the best conditions for fish (i.e., turbine operations within 1% of peak efficiency). NMFS turbine survival studies in the Snake River produced estimates of 92.7%, 92.0%, and 86.5% at Lower Granite, Little Goose, and Lower Monumental Dams in 1995, 1993, and 1994, respectively, for turbines operating within 1% of peak efficiency. Steelhead survival from turbine passage at Little Goose Dam in 1997 was 93.4% under similar conditions (Muir et al. 2001).

Rocky Reach Dam has eleven Kaplan turbine units, four of which are larger. The existing Kaplan units are gradually being replaced with newer Kaplan units designed to both increase operating efficiency and to reduce gaps between the turbine runner blades and the hub (these gaps have been identified as one of the potential sources of fish injury and mortality within the turbine environment (Ferguson 1993)). Currently, nine of the eleven Kaplan units have been replaced with this new design. It is projected that by the time the fish bypass system construction is completed, all eleven Kaplan units will have been replaced with the newer design. Given these differences in turbine design, particularly in the fixed blade units, the direct and indirect survival information from offsite evaluations may not be representative of conditions at the RRE project.

### ***Juvenile Passage Through Bypass Systems***

Estimates of the direct survival rate of juvenile salmon and steelhead through bypass systems includes mortality rates associated with turbine intake screens, gatewells, orifices, bypass flumes, dewatering screens, sampling facilities (including holding tanks), and bypass outfall conduits. Estimates of direct bypass mortality found at sampling facilities for the bypass systems at the Federal hydroelectric projects on the Snake and lower Columbia rivers suggest that the

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direct mortality of both wild yearling steelhead and chinook salmon is generally less than one percent (Martinson *et al.* 1997; Spurgeon *et al.* 1997; summarized in NMFS FCRPS Supplemental Biological Opinion 1998) although some level of stress or injury may result in mortality later in the life cycle. Bypass survival may also be indirectly affected by predation at poorly located outfall sites or by delayed mortality associated with injuries caused by the bypass system. Bypass system outfalls that concentrate juvenile salmon and steelhead into a comparatively small volume of water may cause high levels of predation related mortality.

The prototype juvenile bypass system at the RRE project has been under development since 1994. This bypass system consists of two relatively large surface bypass entrances (approximately 5.9 kcfs total inflow) located near turbine units one and three, and guidance screens in turbine units one and two. Chelan PUD's proposed action is, in part, to replace this temporary prototype system with a new, permanent juvenile bypass system.

### ***Juvenile Passage Through Spill***

Whitney *et al.* (1997) reviewed 13 estimates of spill mortality (three for steelhead and 10 for salmon) published through 1995 and concluded that zero to two percent mortality is the most likely range for standard spill bays. However, they also pointed out that local conditions such as back eddies, or other situations that may favor predators, may lead to higher spillway passage mortality. In general however, relative to other means of passage currently available spillways are the most benign routes for juveniles to pass the Mid-Columbia River projects, including Rocky Reach Dam (Chapman *et al.* 1994a; Chapman *et al.* 1994b). Unfortunately, increasing spill may result in higher levels of TDG and thus a greater incidence of gas bubble trauma (GBT) in UCR spring chinook salmon and steelhead. As a result, the survival of both the juvenile and adult life stages may be reduced. This emphasizes the importance of the physical and biological TDG monitoring programs at the PUD and Federal dams.

In recent years, Chelan PUD has generally spilled approximately 15% of the total river flow at RRE during the spring migration period, seven days per week, for up to 42 days.

### ***6.2.2.2. Specific Effects***

The following information analyzes the specific effects that operation of the RRE project will likely have on juvenile UCR spring chinook salmon and steelhead. NMFS reviewed the analyses contained in the biological assessment provided by Chelan PUD and considered additional data where appropriate. As previously mentioned in Section 6.1.2, because the relevant life-cycle analysis has already been conducted in NMFS' 2000 FCRPS BiOp, this biological opinion will evaluate expected survival within the action area (Section 6.2) and compare the results with HCP criteria (Combined Adult and Juvenile Project Survival equaling at least 91% or Juvenile Project Survival equaling at least 93% or Juvenile Dam Passage Survival equaling at least 95%) to determine if species-level biological requirements are likely to be met.

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As noted above in Section 6.2, NMFS considers PIT-tag based estimates of juvenile project survival to be the best information available. PIT-tag studies at Rocky Reach Dam rely primarily on subsequent detections at McNary Dam and other lower Columbia River FCRPS projects. Thus, PIT-tag studies using a paired release-recapture methodology are more likely to capture any direct, indirect, or delayed effect of the project in the survival estimate than either radio-telemetry, acoustic tag, or balloon tag studies.

Table 6-1. Summary of juvenile project survival estimates from PIT-tag studies at the Rocky Reach Project, 1998-2000. Sources: Eppard et al. 1999 and Bickford et al. 2001, summarized in Skalski et al. 2001.

Year	Species (Rearing Type)	Method Paired or Single Release Model) <sup>1</sup>	Survival Estimate	Standard Error	Agency Conducting the Study
1998	Yearling Chinook (Hatchery)	Paired release-recapture model	0.859	0.042	NMFS <sup>2</sup>
1998	Yearling Chinook (Hatchery)	Single release-recapture model	0.952	0.066	Douglas County PUD
1999	Steelhead (Hatchery)	Single release-recapture model	0.959	0.010	Douglas County PUD
2000	Steelhead (Hatchery)	Single release-recapture model	0.967	0.008	Douglas County PUD

<sup>1</sup> Single release-recapture models can only measure project effects from the point of release (Wells Dam tailrace) to the PIT-tag detector at RRE dam. Thus, mortality associated with passage via turbines or the spillway or in the tailrace of Rocky Reach Dam are not included in these estimates. Therefore these survival estimates are likely somewhat higher than would have been measured if paired release-recapture model had been utilized. Future studies to determine RRE project survival estimates will be based on paired release methodologies.

<sup>2</sup> For comparison, Eppard et al. 1999 also provided a single release-recapture estimate of 0.872 (assuming a tag loss / handling mortality of 4.2%).

The juvenile survival standard in the HCP (which was analyzed in NMFS' 2000 FCRPS BiOp) is 95% dam passage survival covering 95% of the run for each species. However, current technology does not allow this standard to be measured definitively.<sup>19</sup> Parties to the HCP negotiations have recently adopted a juvenile project survival standard of 93% (roughly 95% dam passage survival with an assumed 2% reservoir mortality) covering 95% of the run for each species as a surrogate standard which can be readily measured with PIT-tag studies and potentially acoustic tag studies. Table 6-1 summarizes PIT tag studies conducted at the RRE project in 1998, 1999, and 2000 when spring spill levels were 15.6%, 15.3%, and 19.3%, respectively. Project survival estimates ranged from 85.9% to 95.2% for yearling chinook

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<sup>19</sup>Methodologies using acoustic tags offer some hope that dam passage survival can be estimated in the near future.

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salmon and from 95.9% to 96.7% for steelhead.<sup>20</sup> NMFS believes that this information is the best currently available for estimating juvenile survival through the RRE project under current operational conditions.

Because single release-recapture model estimates are inconclusive, and likely biased high (see footnote 10 and Table 6-1) to an unknown extent, NMFS cannot conclude at this time that the 93% project survival standard is being met for UCR spring chinook salmon and steelhead at present. However, these PIT tag studies do suggest that with relatively modest improvements to project facilities and operations, this survival standard will likely be met. This is based on the new bypass system, in combination with the additional three weeks of 25% spill as described in the proposed action

### *Juvenile Passage Through Turbine Units*

Based on studies conducted from 1998 to 2000, between 47.6% and 57.9% (average of 53.1%) of the radio-tagged steelhead and 26.8% and 40.8% (average of 35.0%) of radio-tagged yearling chinook salmon passed the dam via the powerhouse (see Appendix B).

Normandeau and Skalski (1996) estimated that the direct survival of balloon-tagged fall chinook salmon passing through the old Kaplan units ranged from 91.3% to 98.7% (weighted average = 95.8%), and ranged from approximately 88.8% to 97.2% (weighted average = 95.0%) for the newly rebuilt Kaplan units. Survival through the fixed blade units for balloon-tagged hatchery reared fall chinook ranged from 91.7% to 100.0% [weighted average = 96.1% (RMC and Skalski 1994)].

The most significant difference between the balloon-tag evaluations conducted in 1993 and 1996 had to do with operation of the test units. In 1993, the units had no restrictions and were operated as needed to meet load. In 1996, load was kept at a constant throughout the test. This may help explain the variability seen in the results between the two years, and may better indicate the range of possible survival levels during normal turbine unit operations. Although neither evaluation was able to discern the indirect effects associated with powerhouse passage, the pilot level survival evaluation conducted using radio-tagged steelhead in 1999 estimated direct and indirect survival at 89.7% (Lady *et al.* 2000), suggesting that the indirect effects associated with turbine passage are more significant than those seen at the bypass system or spillway.

It is clear that the juvenile passage through turbines results in the highest mortality rates

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<sup>20</sup> As noted in Table 6-1, Single release-recapture models can only measure project effects from the point of release (Wells Dam tailrace) to the PIT-tag detector. Thus, mortality associated with passage via turbines or the spillway or in the tailrace of Rocky Reach Dam are not included in these estimates. Therefore these estimates are likely higher than would have been measured if paired release-recapture model had been utilized. Future PIT-tag studies to determine Rocky Reach project survival estimates will be based on paired releases.

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compared to bypass systems or spillways. Thus, the proposed action (compared to current conditions) should reduce the proportion of juvenile UCR spring chinook salmon and steelhead passing through turbines at the RRE project which will likely result in improved dam and project juvenile survival rates.

### ***Juvenile Passage Through the Bypass System***

Fish passage efficiency has been evaluated at the RRE project prototype surface bypass system over the past several years. Following the more significant facility modifications completed by 1998, juvenile passage through the existing bypass system ranged from 26.3% to 39.2% (average of 33.1%) for yearling chinook salmon and 47.1% to 57.3% (average of 52.5%) for steelhead (see Appendix B).<sup>21</sup> PIT-tag studies provide additional information confirming that steelhead are more likely to utilize the current bypass system than yearling chinook salmon.<sup>22</sup>

Marked-fish have also been released directly into the surface bypass system to assess injury and mortality (Peven *et al.* 1996, 1998 and Mosey *et al.* 1999, 2000). Based on the most recent information, descale and/or injuries to spring chinook salmon resulting from the bypass system average 2.65%, 0.51%, 3.77% and 3.70% at the surface collector first entrance, turbine unit one screens, turbine unit two screens and the surface collector second entrance, respectively (Mosey *et al.* 2000). For steelhead, descale and/or injuries averaged 0.00%, 0.00%, 1.85% and 0.79% at the surface collector first entrance, turbine unit one screens, turbine unit two screens and the surface collector second entrance, respectively (Mosey *et al.* 2000).

The indirect effects of passage through the bypass system have not been evaluated at the RRE project. Although project survival evaluations have been conducted, there is no way of determining what component of the survival estimate is related to the indirect effects of passage through the bypass system.

Juvenile passage through appropriately designed bypass systems results in low mortality rates similar to those observed for juvenile passage through spillways. Thus, the operation of the new juvenile bypass system should increase the proportion of juvenile UCR spring chinook salmon

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<sup>21</sup> Appendix B summarizes studies providing route specific passage information at Rocky Reach Dam from 1998 to 2000. These include: 1) radio-telemetry and acoustic tag studies conducted by English *et al.* 1998, 1999, and 2000; Lady *et al.* 2000; and Steig *et al.* 2001 and 2) PIT-tag studies conducted by Mosey *et al.* 1999 and 2000; Murphy *et al.* 2000; and Murphy and Mosey *et al.* (in press).

<sup>22</sup> PIT-tagged fish (in addition to those used for project survival studies) were also used to assess the proportion of fish utilizing the bypass system at Rocky Reach Dam. From 1998-2000, fish were released in the immediate forebay area, precluding passage over the spillway (Appendix B). In 2001, fish were released at Turtle Rock Island and at the mouth of the Entiat River, however, no spill was provided that year. Thus, while the PIT-tag estimates may be interesting for comparative purposes, they are considered less reliable than the bypass efficiencies estimated for radio and acoustic-tagged fish released at Turtle Rock (approximately 4 km upstream of the Rocky Reach Dam) between 1998 and 2000.

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and steelhead passing the RRE project via this route (reducing the proportion passing through turbines) which will likely result in improved dam and project juvenile survival rates.

### ***Juvenile Passage Through the Spillway***

Spill at the RRE project is less effective than at most other projects on the Columbia and Snake rivers. Between 1998 and 2000, only 7.5% to 17.9% (average of 13.8%) of the radio-tagged spring chinook salmon and 9.8% to 16.0% (average of 12.5%) of the steelhead utilized the spillway to pass the project when spill ranged from 15.3% to 19.3% of total project flows (see Appendix B).

While fish passage efficiency at the spillway is comparatively low, a survival evaluation conducted in 1980 on hatchery reared coho estimated survival between 95.4% and 103.8% (weighted average = 99.6% (Heinle and Olson 1981). During this evaluation, 30 kcfs was released from a single bay, arguably resulting in conditions much worse than could be expected from distributing the flow more evenly over the entire spillway. Survival estimates of greater than 100% (test fish survival greater than control fish survival) reduces NMFS' confidence in this data. However, in the 2000 FCRPS BiOp, NMFS estimated that juvenile survival of spring chinook and steelhead through spillways is generally between 98% and 100%.

Juvenile passage through spillways produces much lower mortality rates than passage through turbines and slightly lower mortality rates than passage through bypass systems. Thus, the proposed action, which includes additional spill (increased duration of 15% spill covering 95% of the juvenile outmigration and a 10% absolute increase for up to a three week period over baseline)<sup>23</sup> should increase the proportion of juvenile UCR spring chinook salmon and steelhead passing the RRE project via the spillway (reducing the proportion passing through turbines) which will likely result in improved dam and project juvenile survival rates.

### **6.2.3. Effects of the RRE Project and Operations on Adult Passage and Survival**

#### ***6.2.3.1. General Considerations***

Three specific components of the adult migrations through the RRE project may affect listed species: delay at project fishways, passage success at project structures, and injuries and mortalities resulting from upstream and downstream passage through project facilities. Each of these components has the potential to increase pre-spawning mortality. For fish that do reach spawning areas, indirect effects associated with passage through multiple dams may reduce fecundity and reproductive success. Unfortunately, the relationship between each of these passage measures and reproductive success is not clearly understood.

Adult UCR spring chinook salmon and steelhead pass upstream via fishways that were installed

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<sup>23</sup> Spill for sockeye could be reduced or increased after 2003 based on evaluations of the effectiveness of the new juvenile bypass system to pass juvenile sockeye salmon.

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during the original construction of the project. The fishways typical consist of an entrance gallery and ladder, a diffuser system that provides additional water at the ladder entrances (to attract fish from the tailrace), and a flow control section at the ladder exit that maintains ladder flow over varying forebay elevations. Observation areas have been established in the ladder to monitor upstream progress. Migrational delays are most likely to occur at fish ladder entrances, in the collection galleries, and during operation of traps. Injury related to fish passage facilities is usually minimal, however system failures (especially at diffuser gratings in the entrance pools) can result in significant injury and mortality.

Adult passage information (e.g., time spent immediately downstream of the dam, success at passing into the collection channel and fishway entrances, time taken to traverse the ladder, etc.) is typically evaluated using radio telemetry techniques. Therefore, project passage information is an assessment of how well radio-tagged fish pass from the tailrace of a specific dam into and through the fishladders. The underlying assumption is that the behavior of radio-tagged fish is generally similar to untagged fish. Laboratory assessments of tagged and untagged fish and several years of field evaluations support this assumption, although little information is available regarding tagging effects on reproductive success. There has not been a direct relationship established between project passage times and reproductive success, although reducing passage times to the greatest extent possible should reduce energy expenditures and improve the likelihood that adult fish will survive to spawn. Although specific criteria are not available, obvious delays in passage may indicate a need for operational or structural modifications.

Adult radio-tagged fish are monitored with aerial and underwater antennas as they move through the tailrace and into and through the fishladders. Additional information can be collected by manually tracking radio-tagged fish from a boat or plane. Project passage times are only developed for radio-tagged fish that successfully bypass the dam. Although fish that do not pass the dam are of equal or greater concern, it is extremely difficult to determine a causative factor for this behavior. Failing to bypass a dam may result from poorly designed passage facilities, inadequate attraction water or complicated flow patterns exacerbated by project operations. Fish that fail to bypass the dam may also be destined for a downstream spawning location or may have been injured prior to reaching the dam (as a result of natural or other effects). Tagging effects or regurgitated tags can also be manifested in the data set and effect these conclusions, none of which are related to operation of the facilities. As a result, the detection rate of radio-tagged fish can not be used to isolate specific cause and effect relationships between passage and reproductive success. The information can be used however, to generally assess the success of adult salmonids migrating upstream through the Columbia River corridor and to develop an index that can be used to assess annual improvements in passage conditions.

Obtaining robust estimates of adult salmon and steelhead survival is difficult, especially when attempting to use passage counts at mainstem hydroelectric dams (Dauble and Mueller 2000). Radio-telemetry studies conducted in the prior to 1996 (e.g. Stuehrenber et al. 1995) in the Columbia River upstream of Priest Rapids Dam are unreliable because of problems associated

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with the tags, receivers, and software used at the time. For example, Wainwright et al. (2001) found that Lotek receivers had data gaps ranging from 10s to 100s of hours over the course of the season and a substantial number of false positives (tags being recorded that were already removed from the river etc.) were being recorded and included in the data set. Thus, while this data should not be used to estimate adult mortality, it does indicate that the behavior of adults in this reach is similar to that of fish migrating through the FCRPS dams on the lower Columbia and Snake rivers. Thus, survival estimates at these projects are likely representative of those at the RRE project.

English et al. (2001) conducted a radio telemetry study of adult steelhead migrating through the Mid-Columbia River in 1999-2000. Of the 224 radio-tagged steelhead detected in the vicinity of Rocky Reach Dam which were not removed prior to spawning (harvested), 214 or 93.3% were either tracked to known spawning areas or successfully passed and remained above Rocky Reach Dam.<sup>24</sup> Of the 205 fish detected at the top of the fishways, 21 (10.2%) fell back below the dam. Mortality rates of 8% have been observed for adults falling back through spillways and 14% to 26% for fallback through turbines (NMFS 2000 - pg 6-27). Fallback through bypass systems like the one proposed at RRE Dam are thought to be much more benign. The proposed action, which provides increased spill levels compared to past years in addition to the new JBS should result in increased survival of adults during the juvenile migration period compared to baseline conditions.

Analysis conducted as part of the 2000 FCRPS BiOp provided estimates of per project survival for adult UCR spring chinook salmon and steelhead. NMFS believes these estimates are generally applicable to FERC-licensed projects on the Columbia River. Thus, NMFS expects that the new Juvenile Bypass Facility (which should provide a safe downstream passage route for adult salmon and steelhead) and the other measures proposed by FERC and Chelan PUD will result in total (natural and project-related) mortality rates of no more than 1.9% to 2.4% for adult UCR spring chinook salmon and 2.7% to 3.2% for upstream migrating adult UCR steelhead (NMFS 2000 - Table 9.7-2). At present these are NMFS' best estimates of the expected take of adult UCR spring chinook and salmon at the RRE project. As discussed above, it is not possible to differentiate natural effects from system related effects at this time. Additional survival information has been compiled in the QAR and included in NMFS' life-cycle analysis (NMFS 2000a and 2000b). The effect of the RRE project on the reproductive success of UCR spring chinook salmon and steelhead is currently unknown.

It appears likely that significant numbers of downstream migrating adult steelhead, or kelts, are migrating through the RRE project. Recent estimates of the proportion of UCR adult steelhead outmigrating as kelts in the vicinity of the RRE project range from 13% to 75% (English et al. 2001). The resulting mortality from operation of the RRE Project is unknown, but likely

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<sup>24</sup> Note: this is not a survival estimate since the ultimate fate (i.e., the survival or mortality) of the fish that were radio-tagged is not known.

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comparable to that observed at the Snake and lower Columbia River projects. In 2001 spill levels at Snake River and lower Columbia River projects were low or non-existent. Only 3% of the 212 radio-tagged kelts released at Lower Granite Dam in 2001 survived to reach the Bonneville Dam tailrace under these conditions (Evans 2002). This translates to an estimated mean per project mortality of nearly 40 percent, which is comparable to estimates of adult survival through turbines NMFS 2000a.

NMFS expects that kelt passage through the new JBS and via the spillway under the project operations proposed by Chelan PUD will significantly reduce kelt mortalities, compared to previous years, resulting from operation of the RRE project.

### 6.2.3.2. *Specific Effects*

The median project passage time for adult spring chinook salmon that successfully bypassed the RRE Project was 36.6 hours during a 1993 evaluation (Stuehrenberg *et al.* 1995). For comparison, summer and fall chinook radio-tagged during this same evaluation passed the project in 22.9 hours and 60.0 hours respectively. Similar project passage rates have been observed at other Mid-Columbia, Lower Columbia and Snake river dams for adult spring chinook salmon. Stuehrenberg *et al.* (1995) also noted that fish successfully bypassing the project moved directly into the collection channel from the tailrace with minimal delay. The majority of the passage delay identified in this study was associated with the collection channel itself. Of the 36.6 hour median project passage time, 70% (25.6 hours) was spent attempting to negotiate the collection channel. Radio-telemetry evaluations conducted with other species in 1997 and 1998 demonstrated similar delay in the collection channel.

The 1993 telemetry evaluation also estimated a 0% fallback rate at the RRE project for spring chinook salmon (none of 211 radio-tagged spring chinook). The only other data available for UCR spring chinook salmon at the RRE project is some limited fallback information in English *et al.* (1998). Although spring chinook were not specifically monitored in this evaluation, some incidental information specific to spring chinook radio-tagged at the Bonneville Dam was included in the study. Of the 4 fish detected, none of the spring chinook (0%) fell back over the dam.

English *et al.* (1998) also provided information on summer steelhead. Of the 24 radio-tagged steelhead that were detected at or above the RRE project, 92% successfully passed and remained above the dam during the study period. For the fish that successfully negotiated the dam, the median project passage time was 26 hours. Only one fallback occurred during the study period. The fate of the other two steelhead that failed to pass Rocky Reach Dam is unknown.

During the 1993 evaluation, approximately 3% (n = 3) of the radio-tagged spring chinook detected below the RRE project were not detected upstream of the project or at any of the monitoring locations downstream of the dam (Stuehrenberg *et al.* 1995). English *et al.* (1998) also noted that 8% (n=2) of the steelhead detected at or above Rocky Reach Dam, but none of

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the spring chinook failed to negotiate the dam in 1997.

The Douglas County PUD has provided additional radio-telemetry information from several river systems in British Columbia, Canada. Radio-telemetry studies conducted on the Nass River in 1992 and 1993 (Koski *et al.* 1993, Koski *et al.* 1996b) documented spring chinook survival between 81% and 90%. In 1993, under different flow conditions, survival was 70% (Koski *et al.* 1994, Koski *et al.* 1996a). Survival rates for summer run steelhead on the Skeena River ranged between 31% and 83% (Koski *et al.* 1995). Based on this information, they conclude that the 11.1% to 22.2% mortality estimated by Stuehrenberg *et al.* (1995) for the Mid-Columbia River in 1993 falls within the range of expected natural mortality. Similar pre-dam information is unavailable for the Mid-Columbia River although one estimate of spring/summer chinook survival developed for the period 1962 through 1968 on the lower Snake River averaged 55% with only one dam in place (estimated by relating ladder counts at Ice Harbor Dam with redd counts in Snake River tributaries)(Bjornn 1998 excerpted from NMFS 2000d).

Each of these techniques for determining survival incorporates several estimates and assumptions that all lead to significant uncertainty in the information base. For example, the survival estimates developed for the Snake River in the 1960s utilized the redd counts of adult spring/summer chinook that had been affected to some degree by the hydrosystem. Fish entering the Snake River system in 1962 had still traversed five hydroelectric facilities, each with some effect on both the juvenile and adult life stages of this species. Although Snake River fish are arguably more similar to UCR spring chinook salmon and summer steelhead than are species adapted to coastal river systems in British Columbia, a direct comparison of the survival rates between any of these species is problematic. Due to the limited amount of radio-telemetry information available for the Mid-Columbia River system, the pitfalls associated with utilizing radio-telemetry data to assess site specific survival, and the environmental and species differences of the natural and impounded river systems evaluated, it is not possible to differentiate between natural and hydrosystem caused mortality at this time.

The proposed action should result in increased adult survival at the RRE project by providing substantially safer passage routes (juvenile bypass system and spillway) for adults volitionally migrating downstream past the project (fall-backs or steelhead kelts). The proposed action should not increase the rate of non-volitional fall-back, which is presently estimated to be very low. The proposed action should have no effect or a slight beneficial effect on adults migrating upstream via the adult fishways.

### **6.2.4. Effects of the RRE Reservoir on Salmonid Migration and Survival**

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### 6.2.4.1. General Considerations

Juvenile mortality in tailraces and reservoirs may result from increased predation exposure, migrational delays, gas bubble disease and altered water temperatures. Passage through reservoirs prolongs migrations and requires higher energy expenditures for juvenile salmonids to reach the ocean. Stress from multiple passage events can deplete energy reserves and cause disease. Prolonged migrations can also cause inappropriate timing for sea-water entry and higher rates of residualism.

The physical effects of water regulation and impoundment are well known (e.g., NRC 1995, NMFS 1995a; ISG 1996) and can be related to the biological requirements of UCR spring chinook salmon and steelhead in the migration corridor. Water regulation at Federal projects modifies the river's natural hydrograph and has an impact on the ocean area influenced by the Columbia River plume. Water regulation reduces flows that would naturally occur in the spring and this, in turn, reduces water velocity. Water velocity is further reduced by impoundments on the mainstem river sections, increasing volume and cross sectional area and creating reservoirs from formerly free-flowing river sections.

Water regulation and impoundments also change water quality factors such as temperature (increased due to mass heat storage) and turbidity (decreased), as well as salmonid prey production (which changes from riverine aquatic insects to lacustrine planktonic organisms). Channel complexity is also reduced in reservoirs, which affects the complexity of fluid dynamics and substrate type (ISG 1996). Load-following power operations may impact juvenile outmigrants by reducing the available food sources and by stranding and entrapping newly emergent fry.

### 6.2.4.2. Specific Effects

The effects of the RRE Reservoir on juvenile UCR spring chinook salmon and steelhead is included in the estimates of survival provided in Table 6-1 (see Section 6.2.2).

Adult spring/summer chinook salmon migration rates through the free flowing river sections above Lower Granite Dam range from 10 to 30 km/day and steelhead migration rates are generally less than 11 km/day (Bjornn 1998, NMFS 2000d). The median adult spring chinook migration rate through the RRE reservoir to the Wells tailrace was 22.7 hours (Stuehrenberg *et al.* 1995), which equates to 47 km/day. English *et al.* (1998) reported median adult steelhead migration rates through the RRE reservoir of 60.3 km/day and 36.6 km/day for spring chinook and steelhead, respectively. Based on the information from these studies, there do not appear to be any adverse effects of reservoir passage on the migration rate of adult spring chinook and steelhead.

Reservoir effects are included in the juvenile survival estimates summarized in Table 6-1. The effect of reservoirs on adult migrants, based on migration rates compared to natural systems, appears to be beneficial (i.e., migration rates are higher through reservoirs than in free-flowing

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rivers). However, this may be offset, at least in part, by delays at the dam (Section 6.2.3). Thus, the overall effect of the RRE project reservoir on adult UCR chinook salmon and steelhead survival is likely negligible to slightly beneficial.

### **6.2.5. Effects of the RRE Project and Operations on Water Quality**

#### **6.2.5.1. General Considerations**

At the Mid-Columbia River projects, spillways are currently the most benign routes for juvenile salmonids to pass the dams (Chapman *et al.* 1994a; Chapman *et al.* 1994b). Unfortunately, spill may result in TDG which may increase the incidence of gas bubble disease (GBD) in juvenile and adult salmonids. GBD can cause stress, injury and mortality in juvenile and adult salmon and steelhead. For these reasons, the Mid-Columbia River PUDs will limit voluntary spillway discharge levels during the fish passage season to ensure that TDG does not exceed 120% of saturation in project tailraces or 115% of saturation in project forebays for more than 12 hours over a 24 hour period. Due to these operational constraints, spill will be limited under normal operating conditions. This spill limitation results in higher levels of fish passing through turbine units and consequently, higher mortality rates to juvenile salmon and steelhead not using the juvenile bypass system.

#### **6.2.5.2. Specific Effects**

Currently, improvements to the prototype fish bypass system coupled with low fish passage efficiency of spill at the RRE Project indicate that large volumes of spill are not required to maximize listed juvenile salmon passage through non-turbine routes. Under current normal operating conditions, the project does not produce significant increases in TDG (<2%) above those measured in the project forebay. Survival, therefore, is not expected to be affected as a result of TDG generated by the surface bypass system at the spillway under current normal operating conditions. During high river discharges, elevated levels of TDG may result from involuntary spill, increasing the incidence of mortality related to GBD. However, large flood-events are relatively rare due to upstream water storage projects.

Thus, that large flood events may negatively affect juvenile and adult UCR spring chinook salmon and steelhead, but, due to considerations of the recurrence of these events, the overall magnitude of this effect will be relatively small. The effect of the RRE project and operations on juveniles and adults when river flows do not exceed powerhouse capacity or TDG waivers issued by the State of Washington is negligible.

### **6.2.6. Effects of Juvenile Bypass System Construction Activities on Adult Migration and Survival**

As previously noted in the BA, construction activities will occur outside the window of juvenile

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spring migration, so the effect of these activities on UCR spring chinook salmon and steelhead should be negligible. Similarly, no construction related impacts should occur for adult UCR spring chinook salmon which migrate prior to the start of construction activities (mid-August). Thus, only adult UCR steelhead migrating in the vicinity of Rocky Reach Dam are likely to be affected by construction activities.

As discussed in the BA, adult steelhead migrating near the construction area could potentially be affected by the following construction events: noise from demolition of existing prototype bypass system or from pile drilling; fluid leaks from demolition, drilling, and construction activities (drilling fluid, motor oil, vegetable oil, and deisel fuel; and increased fine sediments in the water column (fill removal and leakage of cementitious grout in drill casings). NMFS agrees that while it is likely that one or more of these events will occur, the magnitude of these impacts is such that the overall effect on adult UCR steelhead will likely be small to negligible.

This determination is based in on the likely magnitude of these effects relative to the size of the Columbia River and the structure of Rocky Reach Dam, and on the fact that only adults migrating in 2002 will be effected. The effect of noises on adult steelhead should be minimized by beginning drilling activities away from the fishway exit and ending nearest the fishway exit after the majority of steelhead have already migrated upstream. With respect to pollutant leaks and spills, the large size of the Columbia River should quickly dilute these contaminants to levels which are unlikely to impact adult steelhead in the vicinity of the dam. Finally, NMFS is confident that the proposed radio-telemetry study and ladder counting will alert Chelan PUD and NMFS to any unforeseen effects on adult steelhead resulting from construction activities in a timely fashion.

The effect of juvenile bypass system construction activities on adult steelhead is likely small to negligible. Proposed monitoring efforts, after further development by the MCCC Coordinating Committee, should provide sufficient information to assess whether or not the adult steelhead migration is suffering large impacts (significant delays or fall-back rates are occurring at the dam). Any construction effects will be confined to a single migration year (2002).

### **6.2.7. Effects of the Predator Control Programs on Juvenile Salmonid Survival**

In order to reduce the predation rates on juvenile migrants, the PUD has proposed to continue implementing northern pikeminnow (*Ptychocheilus oregonensis*) and avian predator control and removal measures. Avian control measures consist largely of land based activities that include gull wires installed across project tailraces and pyrotechnics to discourage predation. These activities do not affect listed species and therefore do not require special permitting. Removal of pikeminnows, however, may result in a take of listed species depending on the harvest methods used (e.g., hook and line and longlines). Previously, NMFS determined these actions resulted in a net benefit to listed populations in the action area (NMFS 1997). NMFS believes that the benefit of this program is captured in estimates of juvenile survival through the RRE Project

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(Table 6-1) and that continuing these anti-predator actions provides a continuing benefit to juvenile UCR spring chinook salmon and steelhead.

The PUD removed 36,757 adult Northern pikeminnow from the tailrace and reservoir of the RRE project from 1995 to 1998. In 1999, an additional 6,796 were removed by angling in the vicinity of the dam. Fishing in the Rocky Reach reservoir contributed to the total catches of 2,294 in a fishing derby and 6,496 from long line fishing in the Rocky Reach and Rock Island reservoirs. No steelhead or spring chinook salmon were taken or harassed as a result of these predator removal efforts (West 1999), although West (1997) reported two steelhead caught at the Rocky Reach Dam and released unharmed in 1997.

Continuing efforts to control and remove predacious-sized northern pikeminnows and avian predators should either increase juvenile UCR spring chinook salmon and steelhead survival in the action area (if the proposed measures ultimately prove more effective than those currently being implemented) or have no effect (if the proposed measures do not prove more effective than those currently being implemented).

### **6.2.8. Summary of the Effects of the Proposed Action on Juvenile and Adult Salmonids in the Action Area**

#### ***6.2.8.1. Effects of the RRE Project and Operations on Juvenile Passage and Survival***

NMFS expects that the proposed spill operation (increased duration and percent compared to previous years) and the new bypass system will increase the proportion of listed juveniles migrating passing the dam via these routes. Based on NMFS' estimates of survival through these routes (98%, 98%, and 91% through the bypass system, spillway, and turbine units, respectively), increasing the proportion of fish utilizing the spillway and JBS will significantly enhance the survival of juvenile UCR spring chinook salmon and steelhead migrating past the project. The best estimates of recent juvenile project survival rates through the RRE project are summarized in Table 6-1 (85.9% to 95.2% for UCR spring chinook salmon and 96% to 97% for UCR steelhead).

Based on this information, NMFS believes there is a high likelihood that after 2003 the proposed action will meet the juvenile survival standards set forth in the draft HCP and used in the life-cycle analysis conducted by NMFS as part of the 2000 FCRPS BiOp NMFS 2000a. In addition, the proposed survival studies in 2004, 2005, and 2006 will ensure that adequate information will be available to determine whether or not juvenile survival standards are being met.

#### ***6.2.8.2. Effect of the RRE Project and Operations on Adult Passage and Survival***

The available radio-telemetry information indicates there is a comparatively lengthy delay in the collection channel of the adult fishway (25.6 hours) for adult spring chinook salmon and that a number of fish may be failing to locate and enter the fishway entrances. The effect of this delay

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at RRE on the spawning success of populations cannot be evaluated at present, but is likely relatively small.

Based on the limited amount of information available to date, NMFS believes that an estimate of total mortality through the RRE Project is best provided by the larger body of information derived from the Snake and Columbia River mainstem FCRPS projects. These estimates are 1.9% to 2.4% for UCR spring chinook salmon and 2.7% to 3.2% for upstream migrating adult UCR steelhead. The new juvenile bypass system should reduce adult mortalities at the RRE project by providing a safe alternative route of passage for adults moving downstream through the project. Similarly, the new JBS and spill operations should significantly improve steelhead kelt survival rates at the RRE project compared to baseline conditions.

At present there is no way to distinguish between natural mortality and project-related mortality. However, an examination of information from natural river systems indicates there is a high likelihood that project related survival rates for adult UCR spring chinook salmon and steelhead meet or exceed 98%, consistent with the draft HCP and more recent negotiations.

### ***6.2.8.3. Effects of the RRE Reservoir on Salmonid Migration and Survival***

The effects of the RRE Reservoir on juvenile UCR spring chinook salmon and steelhead is included in the estimates of survival provided in Table 6-1 (see Section 6.2.2).

Based on the estimates of median migration rates through the RRE reservoir (47 km/day) (Stuehrenberg et al. 1995), NMFS does not believe there is any adverse effects of reservoir passage on adult migration rate, and by extension survival, for adult UCR spring chinook salmon or steelhead.

### ***6.2.8.4. Effects of the RRE Project and Operations on Water Quality***

NMFS believes that juvenile and adult UCR spring chinook salmon and juvenile UCR steelhead will be negatively affected by high total dissolved gas levels resulting from involuntary spill resulting from large flood events. However, due, to the low frequency of these events, the overall magnitude of this effect will likely be small at RRE dam.

### ***6.2.8.5. Effect of Juvenile Bypass Construction Activities***

As previously noted in the BA, construction activities will occur outside the window of juvenile spring migration, so the effect of these activities on UCR spring chinook salmon and steelhead should be negligible. Similarly, no construction related impacts should occur for adult UCR spring chinook salmon which migrate prior to the start of construction activities (mid-August). Thus, only adult UCR steelhead migrating in the vicinity of Rocky Reach Dam are likely to be affected by construction activities.

As discussed in the BA, adult steelhead migrating near the construction area could potentially be affected by the following construction events: noise from demolition of existing prototype

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bypass system or from pile drilling; fluid leaks from demolition, drilling, and construction activities (drilling fluid, motor oil, vegetable oil, and deisel fuel; and increased fine sediments in the water column (fill removal and leakage of cementitious grout in drill casings). NMFS believes that while it is likely that one or more of these events will occur, the magnitude of these impacts is such that the overall effect on adult UCR steelhead within the action area will likely be small to negligible.

This determination is based in on the likely magnitude of these effects relative to the size of the Columbia River and the structure of Rocky Reach Dam, and on the fact that only adults migrating in 2002 will be effected. The effect of noises on adult steelhead should be minimized by ensuring that piles furthest from the fishway exit are drilled during the migration period. With respect to pollutant leaks and spills, the large size of the Columbia River should quickly dilute these contaminants to levels which are unlikely to impact adult steelhead in the vicinity of the dam. Finally, NMFS is confident that the proposed radio-telemetry study and ladder counting will alert Chelan PUD and NMFS to any unforeseen effects on adult steelhead resulting from construction activities in a timely fashion.

### ***6.2.8.6. Effects of the Predator Control Programs***

NMFS continues to believe that predator control activities provide a substantial net benefit to juvenile UCR spring chinook salmon and steelhead migrating through the RRE project. The benefits of the current program are included in estimates of project survival. To the extent that additional measures are implemented to increase the effectiveness of the overall program, juvenile survival through the project should increase. Any resulting benefits of anti-predator measures will be captured in the proposed juvenile survival studies (2004 - 2006).

Predator control measures should have no effect on adult UCR spring chinook salmon or steelhead.

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### **7. CUMULATIVE EFFECTS**

Cumulative Effects are defined in 50 CFR 402.02 as *those effects of future State, tribal, local or private actions, not involving federal activities, that are reasonably certain to occur in the action area considered in this Biological Opinion.* Future federal actions, including the ongoing operation of hatcheries, fisheries, and land management activities are not considered in this section because they require separate consultations pursuant to Section 7 of the Act.

Cumulative effects are described in the 2000 FCRPS BiOp and considered in NMFS' life-cycle analysis (NMFS 2000 and in Appendix A).

#### **7.1. Total Dissolved Gas TMDL**

The Washington Department of Ecology is currently developing a total dissolved gas Total Maximum Daily Load (TMDL) for the Mid-Columbia River (confluence with the Snake River to the Canadian border). This process will:

- define the numerical targets for the TMDL
- characterize existing conditions
- identify sources and evaluate linkages between sources and the dissolved gas response of the river
- quantify loading capacity
- allocate loads

NMFS expects that this TMDL will be completed and submitted to the Environmental Protection Agency for approval in 2002. Implementation of this TMDL would start shortly after and is expected to improve the environmental baseline with respect to the biological requirements of juvenile and adult UCR spring chinook salmon and steelhead in the action area (migration corridor).

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### **8. CONCLUSIONS**

This section presents NMFS' opinion regarding whether the aggregate effects of the factors analyzed under the environmental baseline (Section 5), effects of the proposed action (Section 6), and the cumulative effects (Section 7) in the action area, when viewed against the current range-wide status of the species, are likely to jeopardize the continued existence of UCR spring chinook salmon and UCR steelhead or result in destruction or adverse modification of critical habitat.

As noted in Section 6.1, because the relevant life-cycle analysis has already been conducted for these ESUs (FCRPS 2000 and Appendix A), this biological opinion will evaluate expected survival within the action area (Section 6.2) and compare the results with HCP criteria to determine if species-level biological requirements are likely to be met.

#### **8.1. Conclusions for UCR Spring Chinook Salmon**

The available information indicates that the proposed action (construction and operation of a juvenile bypass system, RRE project operations, and predator control measures) has a high probability of achieving the HCP survival standards: 93% juvenile project survival and 95% dam passage survival for juvenile UCR spring chinook salmon. Similarly, the available information indicates that there is a high likelihood of achieving the 91% combined adult and juvenile project survival standard (i.e., project-related mortality of adults is likely less than 2%). Thus, after reviewing the current status of UCR spring chinook salmon, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of this species or result in destruction or adverse modification of their critical habitat through July 12, 2006.

For juveniles, this conclusion is based on recent project survival estimates (Table 6-1 in Section 6.2.2) and the expected survival improvements for juveniles migrants resulting from the following elements of the proposed action:

- increasing the duration (15% of project inflows will be spilled to cover 95% of the juvenile migration) and level (if the HCP is signed, an additional 10% of project inflows will be spilled for up to three weeks to improve migration conditions for juvenile sockeye salmon)<sup>25</sup> of spill at the project should increase survival by increasing the proportion of juveniles passing the project via spillways (estimated survival of 98%) and reducing the proportion of juveniles passing the project via turbines (estimated survival of 91%) (Section 6.2.2 and 6.2.8);

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<sup>25</sup> Spill for sockeye could be reduced or increased after 2003 based on evaluations of the effectiveness of the new juvenile bypass system to pass juvenile sockeye salmon.

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- the juvenile bypass system should likewise increase survival by increasing the proportion of juveniles passing the project via the bypass system (estimated survival of 98%) and decreasing the proportion of juveniles the project via turbines (estimated survival of 91%) (Section 6.2.2 and 6.2.8);
- Total Dissolved Gas levels resulting from spill operations for juvenile migrants will not exceed the State of Washington's provisions for TDG related to voluntary fish spill and should not effect juvenile survival at the project (Section 6.2.5 and 6.2.8);
- the juvenile bypass system will be constructed outside the migration window of juveniles so there will be no effect on juvenile survival resulting from related construction activities (Section 6.2.6 and 6.2.8);
- predator control measures should either increase juvenile survival (if measures beyond those currently being implemented prove effective) or have no effect on juvenile survival (if measures beyond those currently being implemented do not prove effective) (Section 6.2.7 and 6.2.8).

For adults, this conclusion is based on recent survival information (Section 6.2.3) and expected impacts on adult migration and survival resulting from the following elements of the proposed action:

- proposed project operations (spill and adult fishway operations) should have no effect, or a small positive effect on adult migration and survival through the project (Section 6.2.3 and 6.2.8);
- the juvenile bypass system should provide a safe, alternative passage route for downstream migrating adults that should result in increased adult survival for fall-backs or volitional migrants compared to turbine passage routes (Section 6.2.3 and 6.2.8);
- Total Dissolved Gas levels resulting from spill operations for juvenile migrants will not exceed expected TDG waivers from the State of Washington and should not effect adult survival at the project (Section 6.2.5 and 6.2.8);
- the juvenile bypass system will be constructed outside the migration window of adults so there will be no effect on adult survival resulting from related construction activities (Section 6.2.6 and 6.2.8);
- predator control measures should have no effect on adult survival (Section 6.2.7 and 6.2.8).

### **8.2. Conclusions for UCR Steelhead**

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The available information indicates that the proposed action (construction and operation of a juvenile bypass system, RRE project operations, and predator control measures) has a high probability of achieving the HCP survival standards: 93% juvenile project survival and 95% dam passage survival for juvenile UCR steelhead. Similarly, the available information indicates that there is a high likelihood of achieving the 91% combined adult and juvenile project survival standard (i.e., project-related mortality of adults is likely less than 2%). Thus, after reviewing the current status of UCR steelhead, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of this species or result in destruction or adverse modification of their critical habitat through July 12, 2006.

For juveniles, this conclusion is based on recent project survival estimates (Table 6-1 in Section 6.2.2) and the expected survival improvements for juveniles migrants resulting from the following elements of the proposed action:

- increasing the duration (15% of project inflows will be spilled to cover 95% of the juvenile migration) and level (if the HCP is signed, an additional 10% of project inflows will be spilled for up to three weeks to improve migration conditions for juvenile sockeye salmon)<sup>26</sup> of spill at the project should increase survival by increasing the proportion of juveniles passing the project via spillways (estimated survival of 98%) and reducing the proportion of juveniles passing the project via turbines (estimated survival of 91%) (Section 6.2.2 and 6.2.8);
- the juvenile bypass system should likewise increase survival by increasing the proportion of juveniles passing the project via the bypass system (estimated survival of 98%) and decreasing the proportion of juveniles the project via turbines (estimated survival of 91%) (Section 6.2.2 and 6.2.8);
- Total Dissolved Gas levels resulting from spill operations for juvenile migrants will not exceed the State of Washington's provisions for TDG related to voluntary fish spill and should not effect juvenile survival at the project (Section 6.2.5 and 6.2.8);
- the juvenile bypass system will be constructed outside the migration window of juveniles so there will be no effect on juvenile survival resulting from related construction activities (Section 6.2.6 and 6.2.8);
- predator control measures should either increase juvenile survival (if measures beyond those currently being implemented prove effective) or have no effect on juvenile survival (if measures beyond those currently being implemented do not prove effective) (Section

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<sup>26</sup> Spill for sockeye could be reduced or increased after 2003 based on evaluations of the effectiveness of the new juvenile bypass system to pass juvenile sockeye salmon.

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6.2.7 and 6.2.8).

For adults, this conclusion is based on recent survival information (Section 6.2.3) and expected impacts on adult migration and survival resulting from the following elements of the proposed action:

- proposed project operations (spill and adult fishway operations) should have no effect, or a small positive effect on adult migration and survival through the project (Section 6.2.3 and 6.2.8);
- the juvenile bypass system should provide a safe, alternative passage route for downstream migrating adults that should result in increased adult survival for fall-backs or volitional migrants (especially steelhead kelts) compared to turbine passage routes (Section 6.2.3 and 6.2.8);
- Total Dissolved Gas levels resulting from spill operations for juvenile migrants will not exceed expected TDG waivers from the State of Washington and should not effect adult survival at the project (Section 6.2.5 and 6.2.8);
- juvenile bypass system construction-related activities (noise and pollutants) will likely have a small, negative effect on adult migration and survival during the 2002 migration - the proposed adult evaluations, after further development and refinement by the MCCC, should provide an adequate “safety net” for adult migrants by ensuring that no large, unforeseen effects are occurring during this time (Section 6.2.6 and 6.2.8);
- predator control measures should have no effect on adult survival (Section 6.2.7 and 6.2.8).

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### **9. INCIDENTAL TAKE STATEMENT**

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of the Incidental Take Statement.

The measures described in this section are nondiscretionary and must be included by FERC in its amendment of the project license. FERC has a continuing duty to regulate the activities of Chelan PUD covered by this incidental take statement pursuant to the license as amended. If FERC fails to include these conditions in the license or Chelan PUD fails to assume and implement the terms and conditions of this incidental take statement, the protective coverage of Section 7(a)(2) may lapse. To monitor the effect of incidental take, Chelan PUD must report the progress of the action and its effect on each listed species to NMFS, as specified in this incidental take statement [50 CFR Section 402.14(i)(3)].

#### **9.1. Amount or Extent of Take Anticipated**

The proposed action (construct and operate a juvenile bypass system, continue operating the RRE Project through July 12, 2006, and predator control measures) is designed to minimize the incidental take of juvenile UCR spring chinook salmon and steelhead.

NMFS expects that in 2002 project-related mortalities (i.e., direct, indirect, and delayed mortality resulting from RRE project effects) of juvenile UCR spring chinook salmon and steelhead will not exceed 14.1% (the highest mortality rate measured for either species between 1998 and 2000 (Section 6.2)). NMFS expects that RRE project-related juvenile mortalities will not exceed 7.0% after 2003, when the proposed action (new Juvenile Bypass System, modified project operations, and predator hazing and removal programs) is fully implemented.

NMFS expects that the proposed action will result in absolute mortality rates of no more than 2.4% for adult UCR spring chinook salmon and 3.2% for upstream migrating adult UCR steelhead (Section 6.3).<sup>27</sup> Taking into account natural mortality, which undoubtedly occurs, it is likely that the draft HCP standard of no more than 2% adult mortality resulting from project-related effects is being met at this time for both ESUs.

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<sup>27</sup> It is important to note that this estimate includes both natural and project-related mortality which cannot, at present, be differentiated with existing technology.

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RRE project-related mortality (absolute mortality minus natural mortality) of downstream migrating UCR steelhead kelts is unknown at this time. Based on the very limited information available at present, the absolute mortality rates for UCR steelhead kelts within the action area should not exceed 40% (Section 6.3). NMFS expects that the proposed action (new JBS and spring spill operations) will provide a substantially lower, but currently undefinable, kelt mortality rate through the RRE project in future years.

### **9.2. Affect of Take**

Previously in this biological opinion (Section 8.1 and 8.2), NMFS has determined that the projected levels of survival through July 12, 2006, are not likely to result in jeopardy to listed UCR spring chinook salmon or steelhead.

### **9.3. Reasonable and Prudent Measures and Terms and Conditions**

NMFS believes the following reasonable and prudent measures and terms and conditions are necessary and appropriate to minimize the impacts of incidental take associated with the proposed actions at the RRE project. In order to be exempt from the prohibitions of Section 9 of the ESA, FERC must incorporate in the amended license and Chelan PUD must comply with all of the reasonable and prudent measures and terms and conditions in this Section 9.3. If implementation is delayed or deferred, NMFS shall then determine whether further consultation is required. This Incidental Take Statement may be modified as a result of this determination and the terms and conditions may subsequently be modified.

If during the course of the action these levels of incidental take are exceeded then such additional incidental take represents new information requiring reinitiation of consultation and review of the terms and conditions and FERC must immediately provide an explanation for the causes of the taking and review with NMFS the need for possible modification of the reasonable and prudent measures in this Incidental Take Statement.

#### **9.3.1. Monitoring Requirements**

10. FERC shall require Chelan PUD to report the results of monitoring studies to assess construction-related effects on adult steelhead (Section 6.2.6) (travel time estimates, fallback rates at the project, and dropback rates in the ladder) to NMFS on a weekly basis, or as otherwise agreed to by NMFS. NMFS expects that the appropriate triggers will be developed and refined in future meetings of the MCCC. These reports should compare monitoring results to the triggers agreed upon by the MCCC. Also, as proposed in the BA, FERC shall require Chelan PUD to immediately notify and consult with NMFS in the event that any of these triggers are exceeded.

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11. FERC shall require Chelan PUD to count adult fish as they migrate through the fishway at the RRE Project and make the information available to NMFS for review on a daily basis.
12. FERC shall require Chelan PUD to report all observations of adult UCR spring chinook salmon and steelhead (noting whenever possible whether adult steelhead are kelts or pre-spawning adults) mortalities or large numbers of juvenile mortalities to NMFS, within two days of the incident, and shall include a concise description of the causative event, if known and a description of any resultant corrective actions taken at the facility. NMFS anticipates that this information can be collected during routine project operations and maintenance activities, including turbine and fishway dewaterings, and during operation of the adult trap or juvenile bypass sampling system.
13. FERC shall require Chelan PUD to report the number of juvenile and adult UCR spring chinook salmon and steelhead (noting whenever possible whether adult steelhead are kelts or pre-spawning adults) taken incidentally to the predator removal programs to NMFS by December 31 of each year. The number of UCR spring chinook salmon and summer steelhead mortalities resulting from the predator removal program shall be reported to NMFS within two days of the incident.
14. FERC shall require Chelan PUD to report the spill levels provided during the spring outmigration each year and the proportion of the juvenile UCR spring chinook salmon and steelhead smolt populations that were covered by that spill program when available, in coordination and with the agreement of the MCCC. This information will be necessary to assess if juvenile project operations are being implemented as outlined in the HCP.

### **9.3.2. Research Reporting Requirements**

2. FERC shall require Chelan PUD to provide status reports of the juvenile monitoring and survival studies, including preliminary results of the proposed juvenile reach survival studies, to NMFS, upon request, throughout the duration of the study. These studies shall be conducted beginning in 2004 using the best techniques currently available (see Appendix C). Final reports shall be submitted to NMFS no later than March 31 of the year following completion of the study. After 2003, reports shall summarize all available survival estimates from appropriate studies (see Appendix C) to date and compare them with the approved 2004 to 2006 incidental take of 7%. If the mortality estimates are higher than 7%, the report shall identify options for reducing mortality to less than 7%.

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2. FERC shall require Chelan PUD to submit status reports of the adult monitoring studies, including preliminary results of the proposed adult fishway timing studies, to NMFS, upon request, throughout the duration of the study. These studies shall be conducted using the best techniques currently available (as agreed upon by the MCCC Coordinating Committee). The final report shall be submitted to NMFS no later than March 31 of the year following completion of the study.
3. FERC shall require Chelan PUD to provide status reports on all other research studies identified in Sections 3 and 9 (which are not specifically mentioned above in Section 9.3.1 or 9.3.2) to NMFS, upon request, throughout the duration of the study. Final reports shall be submitted no later than March 31 following completion of the study.

### **9.3.3. Kelt Survival Estimation**

FERC shall require Chelan PUD to determine, in consultation with NMFS, the feasibility of conducting studies to better define losses of kelts migrating through the RRE project. As previously noted, the mortality of kelts passing through the RRE project is unknown. If feasible, the completion of this study would allow NMFS to set a numerical level of incidental take for kelts and would result in a better method of monitoring that incidental take.

1. FERC shall require Chelan PUD, in consultation with NMFS, to determine the feasibility of conducting studies to better define losses of kelts through the RRE project by December 31, 2002. The study approach may include the use of radio-telemetry or other techniques to more precisely estimate the number of kelts migrating through RRE dam and reservoir. Ideally, the study would utilize tagged adults migrating upstream to spawn the previous year to eliminate handling effects.
2. FERC shall require Chelan PUD to obtain NMFS concurrence on the study plan and to implement these studies, if feasible, no later than 2005.
3. FERC shall require Chelan PUD to provide the status reports and preliminary results of the studies to NMFS upon request. Annual reports will be submitted to NMFS no later than March 31 of the year following the study.

### **9.3.4. Annual Fish Passage Plan Updates**

1. By December 31, 2002, and each year thereafter, FERC shall require the licensee to provide a draft Fish Passage Plan to NMFS, unless otherwise agreed to by NMFS, detailing the procedures utilized by Chelan PUD to operate the adult fishway and the juvenile bypass system. Following review by NMFS and the

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MCCC, the Fish Passage Plan will be finalized by March 31, of the following year and its actions implemented by April 1, or as soon as necessary to cover 95% of the juvenile migration and the entire adult migration of UCR spring chinook salmon and steelhead.

### **9.3.5. Facilities Access and Evaluation**

1. FERC shall require the licensee to grant NMFS personnel access to all fish passage related project facilities immediately upon request. Such open access to project fish passage facilities is intended to assure compliance with this Incidental Take Statement.

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### **10. CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are intended to guide discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to minimize or avoid adverse modification of critical habitat, to help implement recovery plans, or to develop information.

1. To evaluate the full range of adult UCR spring chinook salmon and summer steelhead passage issues, Chelan PUD, with NMFS participation and approval, should conduct radio-telemetry evaluations that encompass a complete range of annual river discharges. These evaluations would require sufficient time to evaluate the facilities during a range flow conditions.
2. To further assist in efforts to minimize impacts to UCR spring chinook salmon and steelhead and determine if the cumulative actions (both Federal and private) are meeting the biological needs of these species in the long term, Chelan PUD, with NMFS participation and approval, should help fund or conduct studies to assess cumulative effects of mainstem hydroelectric projects on the survival and viability of juvenile and adults in the Columbia River. Several examples of such studies include: 1) evaluations of potential differences in survival between naturally spawned and hatchery reared spring chinook salmon and steelhead, 2) evaluations of adult system survival and subsequent spawning success, and 3) evaluations of hydroelectric project related versus natural mortality rates and spawning success rates.
3. Chelan PUD in coordination with NMFS should ensure that adult PIT-tag detection devices are developed and installed at RRE project adult fishway by April 1, 2005. Adult PIT-tag detectors have been developed for specific fishladders with 18-inch and 24-inch orifices and field tested in 2001. Testing should continue in 2002 and 2003. Information from the adult PIT-tag detectors can assist in determining inter-dam loss and project survival rates.
4. Chelan PUD, in coordination with NMFS, should participate in regional efforts to develop methodologies for evaluating the effects of passage through multiple dam systems on the fecundity, spawning success and survival of adult salmonids. The PUD should then utilize these methodologies to help determine system effects on listed salmonids.
5. Chelan PUD, in coordination with NMFS, should participate in regional efforts to assess the magnitude, contribution to population diversity and growth, and potential actions to provide safe passage for UCR steelhead kelts.

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In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, FERC or Chelan PUD should notify NMFS when conservation recommendations are implemented.

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### **11. REINITIATION OF CONSULTATION**

This concludes formal consultation on the FERC approval of the actions proposed by Chelan PUD. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (4) a new species is listed or critical habitat is designated that may be affected by the action; or (5) no later than July 12, 2006.

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### **13. MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT**

#### **13.1. Background**

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));
- NMFS must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A));
- Federal agencies must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NMFS is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

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### 13.2. Identification of EFH

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of federally-managed Pacific salmon: chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information.

### 13.3. Proposed Actions

The proposed action and action area are detailed above in Sections 3 and 5.1 of this biological opinion. The action area includes habitats that have been designated as EFH for various life-history stages of chinook salmon (*O. tshawytscha*) and coho salmon (*O. kisutch*) once established.

### 13.4. Effects of Proposed Action

As described in detail in Section 6 of this Biological Opinion, the proposed action may result in short- and long-term adverse effects to a variety of habitat parameters. These adverse effects to chinook salmon and coho salmon (once establish) are:

#### ***Mainstem Spawning Habitat***

- inundation of mainstem summer/fall chinook salmon spawning habitat upstream of the RRE project;
- altered mainstem summer/fall chinook spawning habitat substrate downstream of the RRE project (reduced proportion of gravels and cobbles downstream of the project);

#### ***Juvenile Rearing Habitat and Juvenile and Adult Migration Corridor***

- altered flow conditions (ramping) that can modify juvenile and adult fish distribution;
- altered invertebrate (food) sources and production in the mainstem migration corridor for juvenile chinook and coho salmon;
- altered water quality, especially TDG resulting from uncontrolled spill at the RRE project;
- higher than natural predation rates resulting from the project enhancing

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- predator habitat or foraging opportunities;
- altered riparian vegetation which can influence cover, food production, temperature, and substrate;
- altered juvenile behavior or reduced survival of juveniles migrating through the action area as a result of project inundation and operations;
- altered adult behavior or reduced survival or spawning success of adults migrating through the action area as a result of project operations.

### **13.5. Conclusion**

NMFS concludes that the proposed action would adversely affect designated EFH for chinook salmon and coho salmon once established.

### **13.6. EFH Conservation Recommendations**

Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NMFS understands that the conservation measures described in the biological assessment (FERC 2001) will be implemented by Chelan PUD, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. However, the Terms and Conditions outlined in Section 9 and the Conservation Recommendations in Section 10 are generally applicable to designated EFH for chinook salmon and coho salmon and address these adverse effects to the extent practical (for example, inundation effects). Consequently, NMFS recommends that the Terms and Conditions in Section 9 and the Conservation Recommendations in Section 10 be adopted as EFH conservation measures.

### **13.7. Statutory Response Requirement**

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

### **13.8. Supplemental Consultation**

The Federal Energy Regulatory Commission must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation

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recommendations (50 CFR 600.920(k)).

### **13.9 References**

FERC (Federal Energy Regulatory Commission). 2001. Biological Assessment of Proposed Fish Bypass System at Rocky Reach Dam (FERC Project No. 2145). Prepared by Public Utility District No. 1 of Chelan County.

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.

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**APPENDIX A**  
**Summary of NMFS' Life-cycle Analysis for**  
**Upper Columbia River Spring Chinook Salmon and Steelhead**

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**APPENDIX B**  
**Summary of Route Specific Passage Studies**  
**at Rocky Reach Dam, 1998 - 2001**

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**APPENDIX C**

**Briefing Paper: Estimating Survival of Anadromous Fish  
Through the Mid-Columbia PUD Hydropower Projects**